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Civilian Nuclear Waste Disposal

Mark Holt
Specialist in Energy Policy

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Summary

Management of civilian radioactive waste has posed difficult issues for Congress since the beginning of the nuclear power industry in the 1950s. Federal policy is based on the premise that nuclear waste can be disposed of safely, but proposed storage and disposal facilities have frequently been challenged on safety, health, and environmental grounds. Although civilian radioactive waste encompasses a wide range of materials, most of the current debate focuses on highly radioactive spent fuel from nuclear power plants. The United States currently has no disposal facility for spent nuclear fuel.

The Nuclear Waste Policy Act of 1982 (NWPA) calls for disposal of spent nuclear fuel in a deep geologic repository. NWPA established the Office of Civilian Radioactive Waste Management (OCRWM) in the Department of Energy (DOE) to develop such a repository, which would be licensed by the Nuclear Regulatory Commission (NRC). Amendments to NWPA in 1987 restricted DOE's repository site studies to Yucca Mountain in Nevada. DOE submitted a license application for the proposed Yucca Mountain repository to NRC on June 3, 2008. The state of Nevada strongly opposes the Yucca Mountain project, citing excessive water infiltration, earthquakes, volcanoes, human intrusion, and other technical issues.

The Obama Administration "has determined that developing the Yucca Mountain repository is not a workable option and the Nation needs a different solution for nuclear waste disposal," according to the DOE FY2011 budget justification. As a result, no funding for Yucca Mountain, OCRWM, or NRC licensing was requested or provided for FY2011 or subsequent years. NRC halted further consideration of the license application in 2011 because of "budgetary limitations," but a federal appeals court on August 13, 2013, ordered NRC to continue the licensing process with previously appropriated funds. NRC completed its safety evaluation report on Yucca Mountain on January 29, 2015.

After halting the Yucca Mountain project, the Administration established the Blue Ribbon Commission on America's Nuclear Future to develop an alternative nuclear waste policy. The commission issued its final report on January 26, 2012, recommending that a new, "single-purpose organization" be given the authority and resources to promptly begin developing one or more nuclear waste repositories and consolidated storage facilities. The commission recommended a "consent based" process for siting nuclear waste storage and disposal facilities.

After OCRWM was dismantled, responsibility for implementing the Administration's nuclear waste policy was given to DOE's Office of Nuclear Energy (NE). In January 2013, NE issued a nuclear waste strategy based on the Blue Ribbon Commission recommendations. The strategy calls for a pilot interim storage facility for spent fuel from closed nuclear reactors to open by 2021 and a larger storage facility to open by 2025. A site for a permanent underground waste repository would be selected by 2026, and the repository would open by 2048.

DOE requested $30 million for FY2016 to develop an integrated waste management system as outlined by the new waste strategy—up from $22.5 million provided for FY2015. The House on May 1, 2015, approved $175 million for DOE and NRC to continue the Yucca Mountain licensing process and provided no funding for DOE's integrated waste strategy (H.R. 2028, H.Rept. 114-91). The Senate Appropriations Committee approved its version of the funding bill on May 21, 2015 (S.Rept. 114-54) with no funds for Yucca Mountain but authorization for an interim spent fuel storage facility.

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Most Recent Developments

The Obama Administration's nuclear waste policy calls for termination of the Yucca Mountain repository project and the development of alternative approaches to waste management. Under the Nuclear Waste Policy Act of 1982 (NWPA), the Yucca Mountain site in Nevada has been the only location under consideration by the Department of Energy (DOE) for construction of a national high-level radioactive waste repository. DOE had submitted a license application for the Yucca Mountain repository to the Nuclear Regulatory Commission (NRC) on June 3, 2008, but the Obama Administration halted funding for the project and moved to withdraw the application on March 3, 2010.

After deciding to terminate the Yucca Mountain repository project, the Administration established the Blue Ribbon Commission on America's Nuclear Future (BRC) to develop a new nuclear waste policy. The commission issued its final report on January 26, 2012, recommending that a new, "single-purpose organization" be given the authority and resources to promptly begin developing one or more nuclear waste repositories and consolidated storage facilities. The recommendations called for a "consent based" process in which the roles of various levels of government in siting and regulating nuclear waste facilities would be established through negotiations. The commission also recommended that long-term research, development, and demonstration be conducted on technologies that could provide waste disposal benefits.

In response to the BRC report, and to provide an outline for a new nuclear waste program, DOE issued a Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Waste in January 2013. The DOE strategy calls for a new nuclear waste management entity to develop consent-based storage and disposal sites, similar to the BRC recommendation. Under the DOE strategy, a pilot interim spent fuel storage facility would be opened by 2021 and a larger-scale storage facility, which could be an expansion of the pilot facility, by 2025. A geologic disposal facility would open by 2048—50 years after the initially planned opening date for the Yucca Mountain repository.

Yucca Mountain Licensing

Responding to a court order that the Yucca Mountain repository licensing process continue as long as previously appropriated funding was available, NRC issued the final two volumes of the Yucca Mountain Safety Evaluation Report (SER) on January 29, 2015. The SER contains the NRC staff's determination of whether the repository would meet all applicable standards. Volume 3 of the SER, issued in October 2014, concluded that DOE's Yucca Mountain repository design would comply with safety and environmental standards after being permanently sealed.[1] However, the staff said upon completing the SER that NRC should not authorize construction of the repository until all land and water rights requirements were met and a supplement to DOE's environmental impact statement (EIS) was completed.[2] NRC ordered its staff on March 3, 2015, to complete the supplemental EIS and make its database of Yucca Mountain licensing documents

[1] NRC, "NRC Staff Issues Volume 3 of Yucca Mountain Safety Evaluation Report," news release 14-069, October 16, 2014, http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1949/v3/.

[2] NRC, "NRC Publishes Final Two Volumes of Yucca Mountain Safety Evaluation," news release 15-005, January 29. 2015, http://www.nrc.gov/reading-rm/doc-collections/news/2015/.

publicly available, using all the remaining previously appropriated licensing funds.[3] NRC Chairman Stephen Burns testified March 4, 2015, that $330 million in additional appropriations would be needed to complete the licensing process, including adjudicatory hearings on as many as 300 issues that have been raised by the state of Nevada and others.[4]

Separate Disposal Facility for Defense Waste

President Obama authorized DOE on March 24, 2015, to begin planning a separate underground repository for high-level radioactive waste generated by nuclear defense activities. This reverses a 1985 decision by the Reagan Administration to dispose of defense and civilian waste together. Energy Secretary Ernest Moniz described the proposed defense-only repository as potentially easier to site, license, and construct than a combined defense-civilian repository, because defense waste constitutes a relatively small portion of total high-level waste volumes and radioactivity and that some defense waste is in forms that might be optimized for certain types of disposal, such as deep boreholes.[5] Moniz also said DOE would begin implementing a process to locate voluntary sites for storage and disposal of civilian nuclear waste.[6]

In a report issued in October 2014, DOE concluded that a defense-only nuclear waste repository "could be sited and developed outside the framework of the Nuclear Waste Policy Act." Under this reasoning, NWPA would not have to be amended to allow a defense-only repository to proceed. However, according to the DOE report, "Any such repository would be subject to licensing by the U.S. Nuclear Regulatory Commission and would have to comply with other NWPA requirements related to state and local participation in the siting process."[7]

Although Congress has approved the Obama Administration's halt in Yucca Mountain funding, it has not amended NWPA, which still names Yucca Mountain as the sole candidate site for a national repository for civilian nuclear waste. The House for several years has approved funding to resume the Yucca Mountain licensing process, although it has been blocked by the Senate. Republican leaders of the House Committee on Energy and Commerce issued a statement on March 24, 2015, criticizing DOE's plan for a defense-only nuclear waste repository as a way to deflect efforts to resume progress on Yucca Mountain.[8]

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[3] NRC, "NRC Staff to Prepare Supplement to Yucca Mountain Environmental Impact Statement," news release 15-016, March 12, 2015, http://www.nrc.gov/reading-rm/doc-collections/news/2015/.

[4] Hiruo, Elaine, and Steven Dolley, "NRC Says Staff Can Finish Yucca Supplemental EIS in 12-15 Months," NuclearFuel, March 16, 2015.

[5] DOE Office of Nuclear Energy, "Deep Borehole Disposal Research: Demonstration Site Selection Guidelines, Borehole Seals Design, and RD&D Needs," undated web page, http://www.energy.gov/ne/downloads/deep-borehole-disposal-research-demonstration-site-selection-guidelines-borehole-seals.

[6] Energy Secretary Ernest Moniz, "A Look Back on the Blue Ribbon Commission on America's Nuclear Future," remarks to Bipartisan Policy Center, March 24, 2015, http://www.energy.gov/articles/secretary-monizs-remarks-look-back-blue-ribbon-commission-america-s-nuclear-future.

[7] DOE, *Assessment of Disposal Options for DOE-Managed High-Level Radioactive Waste and Spent Nuclear Fuel*, October 2014, p. iii.

[8] House Committee on Energy and Commerce, "Committee Leaders Respond to DOE's Nuclear Waste Delay," March 24, 2015, http://energycommerce.house.gov/press-release/committee-leaders-respond-doe%E2%80%99s-nuclear-waste-delay.

Consent-Based Siting Legislation

Bipartisan legislation (S. 854) that would implement several of the major BRC recommendations was introduced March 24, 2015, by Senator Lamar Alexander, chairman of the Senate Appropriations Subcommittee on Energy and Water Development. S. 854 would establish an independent Nuclear Waste Administration to find sites for nuclear waste storage and disposal facilities with the consent of state and local officials and affected Indian tribes.

Development work could begin immediately on a pilot storage facility for waste from decommissioned reactors and emergency waste shipments from operating reactors. Work on interim storage facilities for other nuclear waste could be conducted within the first 10 years after enactment as long as funding had been obligated for a permanent repository. After 10 years, additional storage facilities could not be sited unless a candidate site had been selected for a permanent repository.

After enactment, all nuclear waste fees paid by nuclear reactor operators would be held in a new working capital fund, which would be available to the Nuclear Waste Administration without further appropriation by Congress. Balances in the existing Nuclear Waste Fund would continue to be subject to appropriation. The Nuclear Waste Administration would be authorized to develop defense-only storage and disposal facilities if the Secretary of Energy determined that defense and commercial nuclear waste should be managed separately.

Co-sponsoring S. 854 were Senator Diane Feinstein, ranking Democrat on the Energy and Water subcommittee, Senator Lisa Murkowski, chairman of the Energy and Natural Resources Committee, and Senator Maria Cantwell, ranking Democrat on the Energy and Natural Resources Committee. The bill is similar to S. 1240 in the 113th Congress.

Voluntary Waste Storage Sites

The waste management company Waste Control Specialists (WCS) announced February 7, 2015, that it would apply for an NRC license to develop an interim storage facility for spent nuclear fuel in Texas. The spent fuel storage facility would be built at a 14,000-acre WCS site near Andrews, TX, where the company currently operates two low-level radioactive waste storage facilities with local support. WCS said it would submit the final license application for the interim storage facility by April 2016 and complete construction by December 2020.[9] Under the WCS proposal, DOE would take title to spent fuel at nuclear plant sites, ship it to the Texas site, and pay WCS for storage for as long as 40 years with possible extensions, according to media reports. DOE's costs would be covered through appropriations from the Nuclear Waste Fund, as were most costs for the Yucca Mountain project. WCS contends that a privately developed spent fuel storage facility would not be bound by NWPA restrictions that prohibit DOE from building a storage facility without making progress on Yucca Mountain.[10]

[9] Valhi, Inc., "Valhi's Waste Control Specialists Subsidiary to Apply for License to Store Used Nuclear Fuel," February 7, 2015, http://www.valhi.net/phoenix.zhtml?c=103380&p=irol-newsArticle&ID=2014598.

[10] Beattie, Jeff, "Waste Control Specialists Sets 2020 Date to Open Spent Fuel Storage Facility," *IHS The Energy Daily*, February 10, 2015, p. 1; Hiruo, Elaine, "Texas Company Seeks License for Spent Fuel Storage," *Nucleonics Week*, February 12, 2015, p. 1.

A local government consortium near the Waste Isolation Pilot Plant in New Mexico, the Eddy-Lea Energy Alliance (ELEA), sent a letter to NRC on February 26, 2013, saying that it would submit a license application for the consolidated spent fuel storage facility envisioned by DOE's waste strategy report. ELEA announced on April 29, 2015, that it had reached an agreement with Holtec International to develop the storage facility but has yet to submit a license application.

Waste Program Appropriations

President Obama's FY2016 budget, submitted to Congress February 2, 2015, included no funding for Yucca Mountain but requested $30 million for FY2016 to develop an integrated waste management system as outlined by the Administration's waste strategy—up from $22.5 million provided for FY2015. Integrated waste management activities would include "preliminary generic process development and other non-R&D activities related to storage, transportation, and consent based siting," according to the DOE justification. Of the $30 million requested for integrated waste management, $24 million would come from the nuclear waste fund.[11]

In addition to integrated waste management, DOE requested $75.4 million for used (spent) fuel research and development, an increase of $26.4 million from the FY2015 level. Planned R&D activities include storage cask testing, modeling of spent fuel behavior during storage and transportation, studies of deep borehole disposal, and analysis and testing of crystalline, clay/shale, and salt rock types for geologic disposal of nuclear waste.

The House passed an FY2016 Energy and Water Development Appropriations bill May 1, 2015, that would appropriate $175 million from the Nuclear Waste Fund to continue the Yucca Mountain licensing process—$150 million for DOE and $25 million for NRC (H.R. 2028, H.Rept. 114-91). No funding would be provided for DOE's integrated waste management program. The House had approved $205 million for Yucca Mountain in the FY2015 Energy and Water bill but the funding was dropped in the enacted version.

The Senate Appropriations Committee approved its version of the FY2016 Energy and Water bill on May 21, 2015 (S.Rept. 114-54), with an authorization for DOE to develop a pilot spent fuel interim storage facility (Sec. 306). Siting of the pilot storage facility would require the consent of the host state and local governments and affected Indian tribes. Priority for use of the facility would be given to spent fuel at closed reactor sites. Similar provisions have been included in previous Senate committee and subcommittee bills but not enacted. Another provision in the FY2016 Senate committee bill (Sec. 311) would explicitly authorize the Secretary of Energy to contract with a private facility—such as the proposed Texas facility discussed above—to store commercial spent fuel to which DOE has taken title. The Senate Committee bill also would provide $30 million to implement Sections 306 and 311. An additional $3 million would be appropriated to prepare for spent fuel transportation to the interim storage facility, as well as $3 million to "develop disposal pathways for defense high-level radioactive waste."

[11] DOE, "FY 2016 Congressional Budget," Vol. 3, p. 466, http://energy.gov/cfo/downloads/fy-2016-budget-justification.

Nuclear Waste Fee Collections

DOE stopped collecting nuclear waste fees from nuclear power generators on May 16, 2014, pursuant to a court ruling.[12] Citing uncertainty about the future of the nuclear waste program, the U.S. Court of Appeals for the District of Columbia Circuit had ordered DOE on November 19, 2013, to stop collecting fees on nuclear power that are supposed to pay for waste disposal. The fees, authorized by NWPA, had been paid by nuclear power generators at the rate of a tenth of a cent per kilowatt-hour and totaled about $750 million per year. NWPA requires the Secretary of Energy to adjust the fees as necessary to cover the waste program's anticipated costs, but the court ruled that DOE's current waste plans are too vague to allow a reasonable estimate to be calculated. The court noted that DOE's most recent cost estimate for the program had an uncertainty range of nearly $7 trillion, a range "so large as to be absolutely useless" for determining the waste fee.[13]

Waste Confidence and Continued Storage Rulemaking

NRC approved a final rule August 26, 2014, on continued storage of spent nuclear fuel.[14] The continued storage rule takes the place of NRC's earlier "waste confidence" rule, which was struck down by the U.S. Court of Appeals for the District of Columbia on June 8, 2012. The waste confidence rule had spelled out NRC's formal findings that waste generated by nuclear power plants would be disposed of safely—specifically, that spent nuclear fuel could be safely stored at nuclear plants for at least 60 years after they had shut down and that permanent disposal would be available "when necessary." The court ruled that NRC should have conducted an environmental review under the National Environmental Policy Act before issuing the most recent waste confidence findings in December 2010.[15] Under previous court rulings, NRC must determine that waste from proposed nuclear plants can be safely managed before licensing them to operate. As a result, after the court struck down the waste confidence rule, NRC halted licensing of new facilities that would generate radioactive waste. In approving the continued storage rule in August 2014, NRC ended its suspension of final licensing decisions for new reactors, spent fuel storage facilities, and license renewals. Several states and environmental groups filed lawsuits to overturn NRC's continued storage rule, which were consolidated by the U.S. Court of Appeals for the D.C. Circuit into a single case October 31, 2014.[16]

Spent Fuel Pool Safety

The March 11, 2011, disaster at Japan's Fukushima Daiichi nuclear power plant increased concern about spent fuel stored in pools of water at nuclear plant sites. To reduce the potential

[12] Hiruo, Elaine, "DOE Implements Court-Ordered Suspension of Nuclear Waste Fee," *NuclearFuel*, May 26, 2014.

[13] See CRS Legal Sidebar WSLG734, *Court Neither Razzled Nor Dazzled by DOE's Failure to Assess Nuclear Waste Fund Fee*, by Todd Garvey.

[14] NRC, "NRC Approves Final Rule on Spent Fuel Storage and Ends Suspension of Final Licensing Actions for Nuclear Plants and Renewals," news release, August 26, 2014, http://pbadupws.nrc.gov/docs/ML1423/ML14238A326.pdf.

[15] U.S. Circuit Court of Appeals for the District of Columbia Circuit, *State of New York, et al. v. Nuclear Regulatory Commission*, No. 11-1045, Decided June 8, 2012, http://www.cadc.uscourts.gov/internet/opinions.nsf/57ACA94A8FFAD8AF85257A1700502AA4/$file/11-1045-1377720.pdf.

[16] Hiruo, Elaine, and Jim Ostroff, "Opponents Take NRC Back to Court over Continued Storage Rule," *NuclearFuel*, November 10, 2014.

hazard of spent fuel storage pools, Senator Edward J. Markey introduced legislation (S. 945) April 15, 2015, to require nuclear power plants to develop NRC-approved plans for removing spent fuel from storage pools. Within seven years after such plans were submitted, spent fuel would have to be transferred to dry storage facilities. A bill introduced by Senator Barbara Boxer the same day (S. 944) would require NRC to maintain full safety and security requirements at permanently closed reactors until all their spent fuel was moved to dry storage.

The loss of power at the Fukushima plant, caused by a huge earthquake and tsunami, disabled cooling systems at the plant's spent fuel pools. Water in the pools was initially feared to have boiled or leaked and dropped below the level of the stored spent fuel, but later analysis indicated that the spent fuel did not overheat. (For more details about Fukushima, see CRS Report R41694, *Fukushima Nuclear Disaster*, by Mark Holt, Richard J. Campbell, and Mary Beth D. Nikitin.) Nevertheless, the incident has prompted numerous recommendations for safety improvements at spent fuel pools. NRC approved an order March 9, 2012, requiring U.S. reactors to install improved water-level monitoring equipment at their spent fuel pools.[17]

Proposed Low-Level Waste Regulations

NRC proposed a significant modification of its low-level waste disposal regulations on March 26, 2015.[18] Among the proposed changes are a requirement that technical analyses for disposal sites include a 1,000-year compliance period for the general public and a dose limit for inadvertent intruders. New analyses would be required for 10,000-year and post-10,000-year periods, along with annual dose minimization targets for the first 10,000 years.

Introduction

Nuclear waste has sometimes been called the Achilles' heel of the nuclear power industry. Much of the controversy over nuclear power centers on the lack of a disposal system for the highly radioactive spent fuel that must be regularly removed from operating reactors.[19] Low-level radioactive waste generated by nuclear power plants, industry, hospitals, and other activities is also a long-standing issue.

Spent Nuclear Fuel Program

The Nuclear Waste Policy Act (P.L. 97-425), as amended in 1987, required DOE to focus on Yucca Mountain, Nevada, as the site of a deep underground repository for spent nuclear fuel and other highly radioactive waste. The state of Nevada has strongly opposed DOE's efforts on the grounds that the site is unsafe, pointing to potential volcanic activity, earthquakes, water

[17] Nuclear Regulatory Commission, "NRC to Issue Orders, Information Request as Part of Implementing Fukushima-Related Recommendations," press release, March 9, 2012, http://www.nrc.gov/reading-rm/doc-collections/news/2012/12-023.pdf.

[18] NRC, "Low-Level Radioactive Waste Disposal; Proposed Rule," 80 *Federal Register* 16082, March 26, 2015.

[19] The term "spent nuclear fuel" is defined by NWPA as "fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing." The nuclear industry refers to this material as "used fuel," because it contains potentially reusable uranium and plutonium.

infiltration, underground flooding, nuclear chain reactions, and fossil fuel and mineral deposits that might encourage future human intrusion.

Under the George W. Bush Administration, DOE determined that Yucca Mountain was suitable for a repository and that licensing of the site should proceed, as specified by NWPA. DOE submitted a license application for the repository to NRC on June 3, 2008, and projected that the repository could begin receiving waste in 2020, about 22 years later than the 1998 goal established by NWPA.

However, the Obama Administration made a policy decision that the Yucca Mountain repository should not be opened, largely because of Nevada's continuing opposition, although it requested FY2010 funding to continue the NRC licensing process. But the Administration's FY2011 budget request reversed the previous year's plan to continue licensing the repository and called for a complete halt in funding and elimination of the Office of Civilian Radioactive Waste Management (OCRWM), which had run the program. In line with the request, the FY2011 Continuing Appropriations Act (P.L. 112-10) provided no DOE funding for the program. DOE shut down the Yucca Mountain project at the end of FY2010 and transferred OCRWM's remaining functions to the Office of Nuclear Energy.

DOE filed a motion to withdraw the Yucca Mountain license application on March 3, 2010, "with prejudice," meaning the application could not be resubmitted to NRC in the future.[20] DOE's motion to withdraw the license application, filed with NRC's Atomic Safety and Licensing Board (ASLB), received strong support from the state of Nevada but drew opposition from states with defense-related and civilian radioactive waste that had been expected to go to Yucca Mountain. State utility regulators also filed a motion to intervene on March 15, 2010, contending that "dismissal of the Yucca Mountain application will significantly undermine the government's ability to fulfill its outstanding obligation to take possession and dispose of the nation's spent nuclear fuel and high level nuclear waste."[21]

The ASLB denied DOE's license withdrawal motion June 29, 2010, ruling that the NWPA prohibits DOE from withdrawing the license application until NRC determines whether the repository is acceptable.[22] The NRC commissioners sustained the ASLB decision on a tie vote September 9, 2011. However, NRC halted further consideration of the license application because of "budgetary limitations."[23] Lawsuits to overturn the Yucca Mountain license withdrawal on statutory grounds were filed with the U.S. Court of Appeals for the District of Columbia Circuit, which ruled on August 13, 2013, that NRC must continue work on the Yucca Mountain license application as long as funding is available. The Court determined that NRC had at least $11.1 million in previously appropriated funds for that purpose.[24]

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[20] *U.S. Department of Energy's Motion to Withdraw*, NRC Atomic Safety and Licensing Board, Docket No. 63-0001, March 3, 2010, http://www.energy.gov/news/documents/DOE_Motion_to_Withdraw.pdf.

[21] National Association of Regulatory Utility Commissioners, "NARUC Seeks Party Status at NRC, Says Yucca Review Must Continue," press release, March 16, 2010, http://www.naruc.org/News/default.cfm?pr=191&pdf=.

[22] U.S. Nuclear Regulatory Commission, Atomic Safety and Licensing Board, Docket No. 63-001-HLW, Memorandum and Order, June 29, 2010.

[23] Nuclear Regulatory Commission, "In the Matter of U.S. Department of Energy (High-Level Waste Repository)," CLI-11-07, September 9, 2011, http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2011/2011-07cli.pdf.

[24] U.S. Court of Appeals for the District of Columbia Circuit, *In re: Aiken County et al.*, No. 11-1271, writ of mandamus, August 13, 2013, http://www.cadc.uscourts.gov/internet/opinions.nsf/
(continued...)

NRC responded November 18, 2013, by directing the agency's staff to complete the Yucca Mountain safety evaluation report (SER), a key document that would provide the staff's conclusions about whether the proposed repository could be licensed.[25] NRC issued Volume 3 of the SER on October 16, 2014, concluding that DOE's Yucca Mountain repository design would comply with safety and environmental standards for 1 million years after being permanently sealed.[26] NRC issued the final two volumes of the Yucca Mountain SER on January 29, 2015.[27]

Upon completing the SER, the staff said that NRC should not authorize construction of the repository until all land and water rights requirements were met and a supplement to DOE's environmental impact statement (EIS) was completed. NRC ordered its staff on March 3, 2015, to complete the supplemental EIS and make its database of Yucca Mountain licensing documents publicly available, using all the remaining previously appropriated licensing funds.[28] NRC Chairman Stephen Burns testified March 4, 2015, that $330 million in additional appropriations would be needed to complete the licensing process, including adjudicatory hearings on as many as 300 issues that have been raised by the state of Nevada and others.[29]

After halting the Yucca Mountain project in 2010, the Obama Administration established the Blue Ribbon Commission on America's Nuclear Future (BRC) to develop alternative waste disposal strategies. The BRC issued its final report on January 26, 2012, recommending that a new, "single-purpose organization" be given the authority and resources to promptly begin developing one or more nuclear waste repositories and consolidated storage facilities. The new organization would use a "consent based" process to select waste facility sites.[30] The BRC had commissioned a series of reports on various aspects of nuclear waste policy to assist in its deliberations.[31]

In response to the BRC report, and to provide an outline for a new nuclear waste program, DOE issued its *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Waste* in January 2013. The DOE strategy calls for a new nuclear waste management entity to develop consent-based storage and disposal sites, similar to the BRC recommendation. Under the DOE strategy, a pilot interim spent fuel storage facility would be opened by 2021 and a larger-scale storage facility, which could be an expansion of the pilot facility, by 2025. A geologic disposal facility would open by 2048—50 years after the initially planned opening date for the Yucca Mountain repository.[32]

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BAE0CF34F762EBD985257BC6004DEB18/$file/11-1271-1451347.pdf.

[25] Nuclear Regulatory Commission, "NRC Directs Staff to Complete Yucca Mountain Safety Evaluation Report," news release No. 13-097, November 18, 2013, http://pbadupws.nrc.gov/docs/ML1332/ML13322B228.pdf.

[26] NRC, "NRC Staff Issues Volume 3 of Yucca Mountain Safety Evaluation Report," news release 14-069, October 16, 2014, http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1949/v3/.

[27] NRC, "NRC Publishes Final Two Volumes of Yucca Mountain Safety Evaluation," news release 15-005, January 29. 2015, http://www.nrc.gov/reading-rm/doc-collections/news/2015/.

[28] NRC, "NRC Staff to Prepare Supplement to Yucca Mountain Environmental Impact Statement," news release 15-016, March 12, 2015, http://www.nrc.gov/reading-rm/doc-collections/news/2015/.

[29] Hiruo, Elaine, and Steven Dolley, "NRC Says Staff Can Finish Yucca Supplemental EIS in 12-15 Months," NuclearFuel, March 16, 2015.

[30] Blue Ribbon Commission on America's Nuclear Future, *Report to the Secretary of Energy*, January 2012, http://brc.gov/sites/default/files/documents/brc_finalreport_jan2012.pdf (BRC Final Report).

[31] Blue Ribbon Commission on America's Nuclear Future, Commissioned Papers, http://cybercemetery.unt.edu/archive/brc/20120620214809/http://brc.gov/index.php?q=library/documents/commissioned-papers.

[32] DOE, *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Waste*, op. cit.

The nuclear power industry supports completion of NRC's licensing review of Yucca Mountain along with the pursuit of alternative storage and disposal facilities. "The target date for opening of Yucca Mountain or an alternative repository site should be no more than 20 years after a consolidated storage site is opened," according to an industry policy statement.[33]

The safety of geologic disposal of spent nuclear fuel and high-level waste (HLW), as planned in the United States, depends largely on the characteristics of the rock formations from which a repository would be excavated. Because many geologic formations are believed to have remained undisturbed for millions of years, it appeared technically feasible to isolate radioactive materials from the environment until they decayed to safe levels. "There is strong worldwide consensus that the best, safest long-term option for dealing with HLW is geologic isolation," according to the National Research Council.[34]

However, as the Yucca Mountain controversy indicates, scientific confidence about the concept of deep geologic disposal has turned out to be difficult to apply to specific sites. Every high-level waste site that has been proposed by DOE and its predecessor agencies has faced allegations or discovery of unacceptable flaws, such as water intrusion or earthquake vulnerability, that could release unacceptable levels of radioactivity into the environment. Much of the problem results from the inherent uncertainty involved in predicting waste site performance for the 1 million years that nuclear waste is to be isolated under current regulations. Widespread public controversy has also arisen over potential waste transportation routes to the sites under consideration.

President Obama's budgets for FY2016 and previous years have included long-term research on a wide variety of technologies that could reduce the volume and toxicity of nuclear waste. The Bush Administration had proposed to demonstrate large-scale facilities to reprocess and recycle spent nuclear fuel by separating long-lived elements, such as plutonium, that could be made into new fuel and "transmuted" into shorter-lived radioactive isotopes. Spent fuel reprocessing, however, has long been controversial because of cost concerns and the potential weapons use of separated plutonium. The Obama Administration refocused DOE's nuclear waste research toward fundamental science and away from the near-term design and development of reprocessing facilities.

President Bush had recommended the Yucca Mountain site to Congress on February 15, 2002, and Nevada Governor Guinn submitted a notice of disapproval, or "state veto," April 8, 2002, as allowed by NWPA. The state veto would have blocked further repository development at Yucca Mountain if a resolution approving the site had not been passed by Congress and signed into law within 90 days of continuous session. An approval resolution was signed by President Bush July 23, 2002 (P.L. 107-200).[35]

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[33] Nuclear Energy Institute, "Nuclear Waste Management: Disposal," October 28, 2014, http://www.nei.org/Issues-Policy/Nuclear-Waste-Management/Disposal.

[34] National Research Council, Board on Radioactive Waste Management, *Rethinking High-Level Radioactive Waste Disposal: A Position Statement of the Board on Radioactive Waste Management* (1990), p. 2.

[35] Senator Bingaman introduced the approval resolution in the Senate April 9, 2002 (S.J.Res. 34), and Representative Barton introduced it in the House April 11, 2002 (H.J.Res. 87). The Subcommittee on Energy and Air Quality of the House Committee on Energy and Commerce approved H.J.Res. 87 on April 23 by a 24-2 vote, and the full committee approved the measure two days later, 41-6 (H.Rept. 107-425). The resolution was passed by the House May 8, 2002, by a vote of 306-117. The Senate Committee on Energy and Natural Resources approved S.J.Res. 34 by a 13-10 vote June 5, 2002 (S.Rept. 107-159). Following a 60-39 vote to consider S.J.Res. 34, the Senate passed H.J.Res. 87 by voice vote (continued...)

Other Programs

Other types of civilian radioactive waste have also generated public controversy, particularly low-level waste, which is produced by nuclear power plants, medical institutions, industrial operations, and research activities. Civilian low-level waste currently is disposed of in large trenches at sites in the states of South Carolina, Texas, and Washington. However, the Washington facility does not accept waste from outside its region, and the South Carolina site is available only to the three members of the Atlantic disposal compact (Connecticut, New Jersey, and South Carolina) as of June 30, 2008. The lowest-concentration class of low-level radioactive waste (class A) is accepted by a Utah commercial disposal facility from anywhere in the United States.

Threats by states to close their disposal facilities led to congressional authorization of regional compacts for low-level waste disposal in 1985. The first, and so far only, new disposal site under the regional compact system opened on November 10, 2011, near Andrews, TX.[36] The Texas Legislature approved legislation in May 2011 to allow up to 30% of the facility's capacity to be used by states outside the Texas Compact, which consists of Texas and Vermont.[37]

Nuclear Waste Litigation

NWPA Section 302 authorized DOE to enter into contracts with U.S. generators of spent nuclear fuel and other highly radioactive waste; under the contracts, DOE was to dispose of the waste in return for a fee on nuclear power generation. The act prohibited nuclear reactors from being licensed to operate without a nuclear waste disposal contract with DOE, and all reactor operators subsequently signed them. As required by NWPA, the "standard contract" specified that DOE would begin disposing of nuclear waste no later than January 31, 1998.[38]

After DOE missed the contractual deadline, nuclear utilities began filing lawsuits to recover their additional storage costs—costs they would not have incurred had DOE begun accepting waste in 1998 as scheduled. DOE reached its first settlement with a nuclear utility, PECO Energy Company (now part of Exelon), on July 19, 2000. The agreement allowed PECO to keep up to $80 million in nuclear waste fee revenues during the subsequent 10 years. However, other utilities sued DOE to block the settlement, contending that nuclear waste fees may be used only for the DOE waste program and not as compensation for missing the disposal deadline. The U.S. Court of Appeals for the 11th Circuit agreed, ruling September 24, 2002, that any compensation would have to come from general revenues or other sources than the waste fund. Subsequent nuclear waste compensation to utilities has come from the U.S. Treasury's Judgment Fund, a permanent account that is used to cover damage claims against the U.S. government. Payments from the Judgment Fund do not require appropriations.

(...continued)

July 9, 2002.

[36] Waste Control Specialists LLC, "Historic Texas Compact Disposal Facility Ready for Business," http://www.wcstexas.com.

[37] Waste Control Specialists LLC, "Waste Control Specialists Commends Passage of Legislation," press release, May 31, 2011, http://www.wcstexas.com/PDF_downloads/WCSAnnounceslegislation.pdf?nxd_id=98546.

[38] The Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste can be found at 10 C.F.R. 961.11.

Through FY2014, nuclear waste payments from the Judgment Fund included $3.2 billion from settlements and $1.3 billion from final court judgments, for a total of about $4.5 billion, according to DOE. By the end of FY2014, 33 lawsuits had been settled, representing utilities that generate 82% of U.S. nuclear electricity. Thirty-one cases had received final court judgments, and 19 cases remained pending.[39] Under the settlements, utilities submit annual reimbursement claims to DOE for any delay-related nuclear waste storage costs they incurred during that year. Any disagreements over reimbursable claims between DOE and a utility would go to arbitration.

Utilities that have not settled with the Department of Justice have continued seeking damage compensation through the U.S. Court of Federal Claims. Unlike the settlements, which cover all past and future damages resulting from DOE's nuclear waste delays, awards by the Court of Claims can cover only damages that have already been incurred; therefore, utilities must continue filing claims as they accrue additional delay-related costs.

DOE estimates that its potential liabilities for waste program delays could total as much as $27.1 billion, including the $4.5 billion already paid in settlements and final judgments.[40]

(For more information about nuclear waste litigation, see CRS Report R40996, *Contract Liability Arising from the Nuclear Waste Policy Act (NWPA) of 1982*, by Todd Garvey.)

Delays in the federal waste disposal program could also lead to future environmental enforcement action over DOE's own high-level waste and spent fuel, mostly resulting from defense and research activities. Some of the DOE-owned waste is currently being stored in non-compliance with state and federal environmental laws, making DOE potentially subject to fines and penalties if the waste is not removed according to previously negotiated compliance schedules.

Nuclear Waste Fee Collections

The National Association of Regulatory Utility Commissioners (NARUC), representing state utility regulators, and the Nuclear Energy Institute (NEI), representing the nuclear industry, filed petitions with the U.S. Court of Appeals on April 2 and April 5, 2010, respectively, to halt the federal government's collection of fees on nuclear power under the NWPA contracts. The suits argued that the fees, totaling about $750 million per year, should not be collected while the federal government's nuclear waste disposal program has been halted.[41] DOE responded that the federal government still intends to dispose of the nation's nuclear waste and that the fees must continue to be collected to cover future disposal costs.[42] Energy Secretary Steven Chu issued a formal determination on November 1, 2010, that there was "no reasonable basis at this time" to conclude that excess funds were being collected for future nuclear waste disposal activities.[43]

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[39] DOE, *Agency Financial Report Fiscal Year 2014*, DOE/CF-0106, November 14, 2014, p. 76, http://energy.gov/cfo/downloads/fy-2014-doe-agency-financial-report.

[40] DOE, *Agency Financial Report Fiscal Year 2014*, op. cit.

[41] NARUC, "State Regulators Go to Court with DOE over Nuclear Waste Fees, news release, April 2, 2010, http://www.naruc.org/News/default.cfm?pr=193; *Nuclear Energy Institute et al. v. U.S. DOE*, Joint Petition for Review, U.S. Court of Appeals for the District of Columbia Circuit, April 5, 2010.

[42] Jeff Beattie, "NARUC, Utilities Sue DOE Over Nuke Waste Fee," *Energy Daily*, April 6, 2010, p. 1.

[43] Secretary of Energy Steven Chu, "Secretarial Determination of the Adequacy of the Nuclear Waste Fund Fee," November 1, 2010, http://energy.gov/sites/prod/files/gcprod/documents/Secretarial_Determination_WasteFee.pdf.

The U.S. Court of Appeals for the District of Columbia Circuit ruled June 1, 2012, that Secretary Chu's determination that the nuclear waste fee should continue unchanged was not "a valid evaluation" and ordered him to conduct a more thorough study of the fee within six months. The court noted that the Secretary's finding relied primarily on costs that had been projected for the Yucca Mountain site, which the Administration had terminated as "unworkable." The court concluded that the Secretary must evaluate the likely costs of reasonable alternatives and the timing of those costs, all of which would affect the level of nuclear waste fees required.[44]

DOE responded with a new fee adequacy assessment in January 2013 that evaluated the total costs of a variety of waste management scenarios. The costs of some scenarios exceeded projected revenues from the existing waste fee by as much as $2 trillion, but other scenarios resulted in a surplus of up to $5 trillion. Because of the widely varying results, DOE concluded that there was no clear evidence that the fee should be immediately raised or lowered.[45]

After NEI and NARUC asked for a review of DOE's latest fee adequacy assessment, the Circuit Court ordered DOE on November 19, 2013, to stop collecting the nuclear waste fees altogether. The Court ruled that DOE's current waste plans were too vague to allow a reasonable estimate to be calculated. The Court noted that DOE's $7 trillion uncertainty range for the program's cost was "so large as to be absolutely useless" for determining the waste fee.[46] Pursuant to the court ruling, DOE stopped collecting nuclear waste fees from nuclear power generators on May 16, 2014.[47]

License Withdrawal

DOE's motion to withdraw the Yucca Mountain license application "with prejudice," meaning that it could not be resubmitted in the future, was filed with NRC's Atomic Safety and Licensing Board (ASLB) on March 3, 2010. DOE's motion argued that the licensing process should be terminated because "the Secretary of Energy has decided that a geologic repository at Yucca Mountain is not a workable option" for long-term nuclear waste disposal. Subsequent DOE statements have reiterated that the license withdrawal motion was not based on scientific or technical findings. Instead, the policy change was prompted by the perceived difficulty in overcoming continued opposition from the state of Nevada and a desire to find a waste solution with greater public acceptance, according to DOE.[48] DOE contended that the license application should be withdrawn "with prejudice" because of the need to "provide finality in ending the Yucca Mountain project."[49]

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[44] U.S. Court of Appeals for the District of Columbia Circuit, *National Association of Regulatory Utility Commissioners v. United States Department of Energy*, No. 11-1066, decided June 1, 2012, http://www.cadc.uscourts.gov/internet/opinions.nsf/4B11622F4FF75FEC85257A100050A681/$file/11-1066-1376508.pdf.

[45] DOE, "Nuclear Waste Fund Fee Adequacy Report," January 2013, http://energy.gov/sites/prod/files/January%2016%202013%20Secretarial%20Determination%20of%20the%20Adequacy%20of%20the%20Nuclear%20Waste%20Fund%20Fee_0.pdf.

[46] See CRS Legal Sidebar WSLG734, *Court Neither Razzled Nor Dazzled by DOE's Failure to Assess Nuclear Waste Fund Fee*, by Todd Garvey.

[47] Hiruo, Elaine, "DOE Implements Court-Ordered Suspension of Nuclear Waste Fee," *NuclearFuel*, May 26, 2014.

[48] Statement of Peter B. Lyons, Assistant Secretary for Nuclear Energy, U.S. Department of Energy, before the Committee on Energy and Commerce, Subcommittee on Environment and the Economy, June 1, 2011.

[49] DOE Motion to Withdraw, op. cit.

The state of Nevada strongly endorsed DOE's motion to withdraw the license application with prejudice[50] and moved to intervene in a court challenge to the license withdrawal.[51] Nevada has long contended that the geology of the site is unsuitable for long-term nuclear waste disposal.

However, DOE's withdrawal motion drew opposition from states and localities with defense-related and civilian nuclear waste that had been expected to go to Yucca Mountain. The state of South Carolina, which has large amounts of high-level radioactive waste at DOE's Savannah River Site, and the state of Washington, which hosts extensive nuclear waste storage facilities at DOE's Hanford Site, filed motions to intervene in the Yucca Mountain licensing proceeding to oppose the license application withdrawal.

NARUC also filed a motion to intervene in the Yucca Mountain licensing proceedings, contending that "dismissal of the Yucca Mountain application will significantly undermine the government's ability to fulfill its outstanding obligation to take possession and dispose of the nation's spent nuclear fuel and high level nuclear waste." NARUC's motion also contended that $17 billion collected from utility ratepayers for the nuclear waste program would be wasted if the Yucca Mountain license application were withdrawn.[52] Also seeking to intervene were Aiken County, SC, and the Prairie Island Indian Community in Minnesota.

The ASLB denied DOE's license withdrawal motion June 29, 2010, ruling that NWPA prohibits DOE from withdrawing the license application until NRC determines whether the repository is acceptable. According to the board, "Surely Congress did not contemplate that, by withdrawing the Application, DOE might unilaterally terminate the Yucca Mountain review process in favor of DOE's independent policy determination that 'alternatives will better serve the public interest.'"[53]

In appealing the ASLB decision to the NRC commissioners, DOE argued in a July 9, 2010, brief that the Secretary of Energy has broad authority under the Atomic Energy Act and Department of Energy Organization Act "to make policy decisions regarding disposal of nuclear waste and spent nuclear fuel." DOE contended that such authority includes "the authority to discontinue the Yucca Mountain project" and that NRC rules provide "that applicants in NRC licensing proceedings may withdraw their applications."[54] After more than a year of deliberation, the NRC commissioners sustained the licensing board's decision on a tie vote September 9, 2011. However, NRC halted further consideration of the license application because of "budgetary limitations."[55]

South Carolina and Aiken County filed challenges to the Yucca Mountain license withdrawal in the U.S. Court of Appeals for the District of Columbia Circuit, contending that NWPA requires

[50] Nicole E. Matthews, "DOE Withdraws Application for Yucca Nuke Dump," *Fox5Vegas.com*, March 3, 2010, http://www.fox5vegas.com/news/22734591/detail.html.

[51] *Motion for the State of Nevada for Leave to Intervene as Intervenor-Respondent*, U.S. Court of Appeals for the Fourth Circuit, Case No. 10-1229, March 19, 2010, http://www.state.nv.us/nucwaste/licensing/nv100319motion3.pdf.

[52] National Association of Regulatory Utility Commissioners, "NARUC Seeks Party Status at NRC, Says Yucca Review Must Continue," press release, March 16, 2010, http://www.naruc.org/News/default.cfm?pr=191&pdf=.

[53] U.S. Nuclear Regulatory Commission, Atomic Safety and Licensing Board, Docket No. 63-001-HLW, Memorandum and Order, June 29, 2010.

[54] *U.S. Department of Energy's Brief in Support of Review and Reversal of the Board's Ruling on the Motion to Withdraw*, Docket No. 63-001-HLW, July 9, 2010.

[55] Nuclear Regulatory Commission, Memorandum and Order, CLI-11-07, September 9, 2011, http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2011/2011-07cli.pdf.

the licensing process to proceed. After NRC rejected the license withdrawal motion, the plaintiffs in that case, including Nye County, NV, where Yucca Mountain is located, petitioned the court to order NRC to continue the licensing proceedings, as noted above.[56] The court held oral arguments in the case May 2, 2012. NRC filed an update with the court on January 4, 2013, contending that the reelection of President Obama and the exclusion of additional Yucca Mountain funding from the most recent FY2013 Continuing Resolution reinforced NRC's suspension of further action on the repository license.[57]

The Court of Appeals ruled on August 13, 2013, that NRC must continue work on the Yucca Mountain license application as long as funding is available. The Court determined that NRC had at least $11.1 million in previously appropriated funds for that purpose.[58] As noted above, NRC completed its Safety Evaluation Report for Yucca Mountain in January 2015 and will use the remaining funds to complete a supplemental EIS and make the licensing database available to the public. Beyond those actions, additional funding of about $330 million would be required to complete the Yucca Mountain licensing review, according to NRC.[59]

Waste Confidence Decision and Continued Storage Rule

Before issuing licenses to nuclear reactors and waste storage facilities, NRC is required by a 1979 court decision to determine that waste from those facilities can be safely disposed of.[60] To meet that requirement, NRC issued a Waste Confidence Decision in 1984 that found that nuclear waste could be safely stored at reactor sites for at least 30 years after plant closure and that a permanent repository would be available by 2007-2009.[61] At that time, DOE officially planned to meet the NWPA repository deadline of 1998.

After DOE's schedule for opening a nuclear waste repository began to slip, NRC updated the Waste Confidence Decision in 1990 to find that a repository would be available by the first quarter of the 21st century.[62] When the Yucca Mountain repository was delayed further and then terminated by the Obama Administration, NRC issued another waste confidence rule in 2010 that found that a repository would be available "when necessary" and that waste could be safely stored at reactor sites for at least 60 years after shutdown.[63]

The state of New York, environmental groups, and others filed lawsuits to overturn the 2010 waste confidence rule on the grounds that NRC had not adequately considered the environmental

[56] U.S. Circuit Court of Appeals for the District of Columbia Circuit, USCA Case #11-1271, Yucca Mountain Reply Brief of Petitioners Mandamus Action, February 13, 2012, http://www.naruc.org/policy.cfm?c=filings.

[57] Freebairn, William, "NRC Says Lack of Funding Supports Decision to Stop Yucca Review," *NuclearFuel*, January 21, 2013.

[58] U.S. Court of Appeals for the District of Columbia Circuit, In re: Aiken County et al., No. 11-1271, writ of mandamus, August 13, 2013, http://www.cadc.uscourts.gov/internet/opinions.nsf/BAE0CF34F762EBD985257BC6004DEB18/$file/11-1271-1451347.pdf.

[59] Hiruo, Elaine, and Steven Dolley, "NRC Says Staff Can Finish Yucca Supplemental EIS in 12-15 Months," NuclearFuel, March 16, 2015.

[60] U.S. Circuit Court of Appeals for the District of Columbia Circuit, *Minnesota v. NRC*, 602 F.2d 412 (D.C. Cir. 1979).

[61] NRC, "Waste Confidence Decision," 49 *Federal Register* 34,658, August 31, 1984.

[62] NRC, "Waste Confidence Decision Review," 55 *Federal Register* 38,474, September 18, 1990.

[63] NRC, "Waste Confidence Decision Update," 75 *Federal Register* 81,037, December 23, 2010.

risks of long-term waste storage at reactor sites. The U.S. Court of Appeals for the District of Columbia Circuit largely agreed, ruling on June 8, 2012, that NRC would have to conduct an environmental review of the Waste Confidence Decision under the National Environmental Policy Act (NEPA). The court found two major flaws in NRC's rulemaking process:

> First, in concluding that permanent storage will be available "when necessary," the Commission did not calculate the environmental effects of failing to secure permanent storage—a possibility that cannot be ignored. Second, in determining that spent fuel can safely be stored on site at nuclear plants for sixty years after the expiration of a plant's license, the Commission failed to properly examine future dangers and key consequences.[64]

Final licensing of new facilities that would produce nuclear waste was halted for more than two years while NRC worked on its response to the court ruling. NRC approved a final rule August 26, 2014, on continued storage of spent nuclear fuel to replace the waste confidence rule that had been struck down.[65] Rather than make specific findings about the future availability of waste disposal facilities, the new continued storage rule describes environmental effects that may result from various periods of waste storage, based on the findings of a generic environmental impact statement (GEIS). The GEIS, issued along with the continued storage rule, responded to the court requirement for NEPA review.

The GEIS analyzed the environmental effects of three potential time periods of storage before a permanent repository would become available: "short-term timeframe," continued storage for up to 60 years after a reactor ceases operation; "long-term timeframe," for up to 160 years after reactor shutdown; and an "indefinite timeframe," in which a repository may never become available. The GEIS assumed that active management and oversight of the stored spent fuel would never end, and that "spent fuel canisters and casks would be replaced approximately once every 100 years." The environmental impact of all three time frames was judged to be minimal in almost all categories.[66]

NRC's continued storage rule was criticized by a coalition of environmental and other groups for allowing licensing of new nuclear reactors to continue while permanent disposal of their resulting waste remained uncertain.[67] The States of Connecticut, New York, and Vermont filed a federal lawsuit October 24, 2014, to vacate the continued storage rule and require NRC to prepare a new environmental impact statement.[68]

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[64] U.S. Circuit Court of Appeals for the District of Columbia Circuit, *State of New York, et al. v. Nuclear Regulatory Commission*, No. 11-1045, Decided June 8, 2012, http://www.cadc.uscourts.gov/internet/opinions.nsf/57ACA94A8FFAD8AF85257A1700502AA4/$file/11-1045-1377720.pdf.

[65] NRC, "NRC Approves Final Rule on Spent Fuel Storage and Ends Suspension of Final Licensing Actions for Nuclear Plants and Renewals," news release, August 26, 2014, http://pbadupws.nrc.gov/docs/ML1423/ML14238A326.pdf.

[66] NRC, "Continued Storage of Spent Nuclear Fuel," 79 *Federal Register* 56238, September 19, 2014. Available at NRC, "Continued Storage of Spent Nuclear Fuel," http://www.nrc.gov/waste/spent-fuel-storage/wcd/documents.html.

[67] Southern Alliance for Clean Energy, news release, September 29, 2014, http://www.cleanenergy.org/17-groups-urge-nrc-to-halt-licensing-relicensing-of-23-reactors-due-to-failure-to-address-2012-court-ruling/.

[68] State of Vermont, Office of the Attorney General, "Vermont Joins Challenge to Nuclear Regulatory Commission's Rule on Storing Spent Nuclear Fuel," October 27, 2014, http://ago.vermont.gov/focus/news/vermont-joins-challenge-to-nuclear-regulatory-commissions-rule-on-storing-spent-nuclear-fuel.php.

Congressional Action

President Obama's proposal to terminate the Yucca Mountain project and search for disposal alternatives, as outlined by DOE's January 2013 nuclear waste strategy, has prompted substantial congressional debate and a number of legislative proposals. The House has consistently opposed the Obama Administration's efforts to abandon Yucca Mountain, while the Senate has generally expressed more interest in alternative waste management proposals. However, the dynamics of the nuclear waste debate could be affected by the change in Senate control in the 114th Congress.

Senator Lamar Alexander, along with Senators Lisa Murkowski, Diane Feinstein, and Maria Cantwell, introduced legislation March 24, 2015, to redirect the nuclear waste program along the lines recommended by the Blue Ribbon Commission and the DOE waste strategy (S. 854). The bill, similar to S. 1240 in the 113th Congress, would establish an independent Nuclear Waste Administration (NWA) to develop nuclear waste storage and disposal facilities. Siting of such facilities would require the consent of the affected state, local, and tribal governments.

Under S. 854, NWA would be required to prepare a mission plan to open a pilot storage facility by the end of 2021 for nuclear waste from shutdown reactors and other emergency deliveries (called "priority waste"). A storage facility for waste from operating reactors or other "nonpriority waste" would open by the end of 2025, and a permanent repository by the end of 2048.

NWA would be authorized to issue requests for proposals or select sites for storage facilities for nonpriority waste only if, during the first 10 years after enactment, the agency had obligated funds for developing a permanent waste repository. After 10 years, NWA could not request proposals for nonpriority waste or select sites unless a candidate site for a repository had been selected. NWA would be authorized to offer financial compensation and other incentives for hosting nuclear waste storage and disposal facilities. Sites that would include storage facilities along with a repository would receive preference.

Highly radioactive defense waste, which had been planned for commingling with commercial nuclear waste since the 1980s, could be placed in defense-only storage and disposal facilities under S. 854, subject to appropriations. President Obama authorized DOE to pursue a defense-only repository on March 24, 2015.

Nuclear waste fees collected after enactment of the bill would be held in a newly established Working Capital Fund. The Nuclear Waste Administration could immediately draw from that fund any amounts needed to carry out S. 854, unless limited by annual appropriations or authorizations. The current disposal limit of 70,000 metric tons for the first repository under NWPA would be repealed.

The Senate Committee on Energy and Natural Resources held a hearing on S. 1240 on July 30, 2013. Energy Secretary Ernest J. Moniz, who had been a member of the Blue Ribbon Commission, said the bill provided "a promising framework for addressing key issues." NARUC Electricity Committee Chairman David C. Boyd called the bill "a step in the right direction," but urged that it require continued licensing action on the Yucca Mountain repository. Boyd noted that S. 1240 would not preclude enforcement of existing NWPA deadlines for action on Yucca Mountain. Natural Resources Defense Council Senior Attorney Geoffrey H. Fettus opposed the bill on the grounds that it would allow temporary waste storage facilities to be opened without progress on a permanent repository and that states would have inadequate authority to regulate

repository safety, among other concerns.[69] As noted above, S. 854 would require certain actions on a permanent repository before a storage facility for nonpriority waste could be sited.

Authorization and initial funding for DOE to develop a pilot spent fuel interim storage facility were approved by the Senate Appropriations Committee in its version of the FY2016 Energy and Water bill on May 21, 2015 (S.Rept. 114-54, Sec. 306). Siting of the pilot storage facility would require the consent of the host state and local governments and affected Indian tribes. Similar language was included in the FY2014 Energy and Water Development appropriations bill passed by the Senate Appropriations Committee June 27, 2013 (S. 1245, §309), as well as in the Committee's FY2013 measure (S. 2465, §312) and in the draft Senate FY2015 Energy and Water bill approved in subcommittee.[70] Corresponding House appropriations bills have not included such an authorization, and it has not been enacted.

The debate over nuclear waste policy was strongly affected by the March 11, 2011, Fukushima Daiichi nuclear accident in Japan. The loss of power at the Fukushima site, caused by a huge earthquake and tsunami, disabled cooling systems at the plant's spent fuel pools. Water in the pools was initially suspected to have boiled or leaked and dropped below the level of the stored spent fuel, potentially leading to fuel damage and radioactive releases into the atmosphere. However, later analysis indicated that the spent fuel did not overheat.

Concerns have been raised in Congress about the risk posed by stored spent fuel, particularly that the cancellation of the Yucca Mountain repository would leave growing amounts of spent fuel indefinitely stored at nuclear plant sites throughout the United States. To reduce the potential hazard of spent fuel storage pools, Senator Edward J. Markey introduced legislation (S. 945) April 15, 2015, to require nuclear power plants to develop NRC-approved plans for removing spent fuel from storage pools. Within seven years after such plans had been submitted, spent fuel would have to be transferred to dry storage facilities. After the seven-year period, additional spent fuel would have to be transferred to dry casks within a year after it had been determined to be sufficiently cool. Emergency planning zones would have to be expanded from 10 to 50 miles in radius around any reactor determined by NRC to be out of compliance with its spent fuel transfer plan. The emergency zone for a decommissioned reactor could not be reduced below a 10-mile radius until all its spent fuel had been placed in dry storage. NRC would be authorized to use interest earned by the Nuclear Waste Fund to provide grants to nuclear power plants to transfer spent fuel to dry storage. Markey introduced a similar bill (S. 2325) in the 113th Congress.

A bill introduced by Senator Barbara Boxer also on April 15, 2015 (S. 944), similar to S. 2324 in the 113th Congress, would require NRC to maintain full safety and security requirements at permanently closed reactors until all their spent fuel was moved to dry storage.

NRC released a study on November 12, 2013, concluding that "expedited transfer of spent fuel to dry cask storage would provide only a minor or limited safety benefit" and "its expected implementation costs would not be warranted."[71]

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[69] Senate Committee on Energy and Natural Resources, Full Committee Hearing to Consider the Nuclear Waste Administration Act of 2013, July 30, 2013, http://www.energy.senate.gov/public/index.cfm/2013/7/full-committee-hearing-to-consider-the-nuclear-waste-administration-act-of-2013.

[70] Senate Committee on Appropriations, "FY15 Subcommittee Reported Bill and Draft Report," July 24, 2014, http://www.appropriations.senate.gov/news/fy-2015-ew-subcommittee-reported-bill-and-draft-report.

[71] Nuclear Regulatory Commission, "Staff Evaluation and Recommendations for Japan Lessons-Learned Tier 3 Issue (continued...)

Characteristics and Handling of Nuclear Waste

Radioactive waste is a term that encompasses a broad range of material with widely varying characteristics. Some waste has relatively slight radioactivity and is safe to handle in unshielded containers, while other types are intensely hot in both temperature and radioactivity. Some decays to safe levels of radioactivity in a matter of days or weeks, while other types will remain dangerous for thousands of years. Major types of radioactive waste are described below:[72]

Spent nuclear fuel. Fuel rods that have been withdrawn from a nuclear reactor after irradiation, usually because they can no longer efficiently sustain a nuclear chain reaction. (The term "spent nuclear fuel" is defined in NWPA. The nuclear industry typically refers to spent fuel as "used nuclear fuel," because it contains uranium and plutonium that could be extracted through reprocessing to make new fuel.) By far the most radioactive type of civilian nuclear waste, spent fuel contains extremely hot but relatively short-lived fission products (fragments of the nuclei of uranium and other fissile elements) as well as long-lived radionuclides (radioactive atoms) such as plutonium, which remains dangerously radioactive for tens of thousands of years or more.

High-level waste. Highly radioactive residue created by spent fuel reprocessing (almost entirely for defense purposes in the United States). High-level waste contains most of the radioactive fission products of spent fuel, but most of the uranium and plutonium usually has been removed for re-use. Enough long-lived radioactive elements typically remain, however, to require isolation for 10,000 years or more.

Transuranic (TRU) waste. Relatively low-activity waste that contains more than a certain level of long-lived elements heavier than uranium (primarily plutonium). Radiation shielding may be required for the handling of some types of TRU waste. In the United States, transuranic waste is generated almost entirely by nuclear weapons production processes. Because of the plutonium, long-term isolation is required. The nation's only permanent repository for TRU waste, the Waste Isolation Pilot Plant (WIPP), near Carlsbad, NM, suspended disposal operations after a radioactive release on February 14, 2014, and does not currently have a target date for restart.[73]

Low-level waste. Radioactive waste not classified as spent fuel, high-level waste, TRU waste, or byproduct material such as uranium mill tailings (below). Four classes of low-level waste have been established by NRC, ranging from least radioactive and shortest-lived to the longest-lived and most radioactive. Although some types of low-level waste can be more radioactive than some types of high-level waste, in general low-level waste contains relatively low concentrations of

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on Expedited Transfer of Spent Fuel," COMSECY-13-0030, November 12, 2013, http://www.nrc.gov/reading-rm/doc-collections/commission/comm-secy/2013/2013-0030comscy.pdf.

[72] Statutory definitions for "spent nuclear fuel," "high-level radioactive waste," and "low-level radioactive waste" can be found in Section 2 of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101). "Transuranic waste" is defined in Section 11ee. of the Atomic Energy Act (42 U.S.C. 2014); Section 11e.(2) of the act includes uranium mill tailings in the definition of "byproduct material." "Mixed waste" consists of chemically hazardous waste as defined by EPA regulations (40 C.F.R. Part 261, Subparts C and D) that contains radioactive materials as defined by the Atomic Energy Act.

[73] DOE, "WIPP Announces Schedule Changes for Resumption of Operations," July 31, 2015, http://www.wipp.energy.gov/wipprecovery/recovery.html.

radioactivity that decays relatively quickly. Low-level waste disposal facilities cannot accept material that exceeds NRC concentration limits.

Uranium mill tailings. Sand-like residues remaining from the processing of uranium ore. Such tailings have very low radioactivity but extremely large volumes that can pose a hazard, particularly from radon emissions or groundwater contamination.

Mixed waste. Chemically hazardous waste that includes radioactive material. High-level, low-level, and TRU waste, and radioactive byproduct material, often falls under the designation of mixed waste. Such waste poses complicated institutional problems, because the radioactive portion is regulated by DOE or NRC under the Atomic Energy Act, while the Environmental Protection Agency (EPA) and states regulate the non-radioactive elements under the Resource Conservation and Recovery Act (RCRA).

Spent Nuclear Fuel

When spent nuclear fuel is removed from a reactor, usually after several years of power production, it is thermally hot and highly radioactive. The spent fuel is in the form of fuel assemblies, which consist of arrays of metal-clad fuel rods 12-15 feet long.

A fresh fuel rod, which emits relatively little radioactivity, contains uranium that has been enriched in the isotope U-235 (usually to 3%-5% from its natural level of 0.7%). But after nuclear fission has taken place in the reactor, most of the U-235 nuclei in the fuel rods have been split into a variety of highly radioactive fission products. Some of the nuclei of the dominant isotope U-238 have absorbed neutrons and then decayed to become radioactive plutonium, some of which has also split into fission products (and some of which are gases). Newly withdrawn spent fuel assemblies are stored in deep pools of water adjacent to the reactors to keep them from overheating and to protect workers from radiation. To prevent the pools from filling up, older, cooler spent fuel often is sealed in dry canisters and transferred to radiation-shielded storage facilities elsewhere at reactor sites. NRC currently requires spent fuel to cool for at least 7-10 years before being transferred to dry storage.[74]

Spent fuel discharged from U.S. commercial nuclear reactors is currently stored at 60 operating nuclear plant sites, 14 shutdown plant sites, and the Idaho National Laboratory.[75] A typical large commercial nuclear reactor discharges an average of 20-30 metric tons of spent fuel per year—an average of about 2,150 metric tons annually for the entire U.S. nuclear power industry. The nuclear industry estimated that the total amount of commercial spent fuel was 71,775 metric tons at the end of 2013, including 22,233 metric tons in dry storage and other separate storage facilities.[76] The total amount of existing waste would exceed NWPA's 70,000-metric-ton limit for Yucca Mountain, even without counting 7,000 metric tons of DOE spent fuel and high-level waste that had also been planned for disposal at the repository.

[74] Nuclear Regulatory Commission, "Staff Evaluation and Recommendations for Japan Lessons-Learned Tier 3 Issue on Expedited Transfer of Spent Fuel," op. cit., Enclosure 1, p. 77.

[75] Gutherman Technical Services, *2012 Used Fuel Data*, January 30, 2013. Adjusted for four sites closed during 2013 and 2014. Includes General Electric's spent fuel storage facility at Morris, IL, located adjacent to the Dresden nuclear plant. Also, the Hope Creek and Salem nuclear plants in New Jersey are counted as a single site.

[76] Gutherman Technical Services, *2013 Used Fuel Data*, January 20, 2014.

As long as nuclear power continues to be generated, the amount of spent fuel stored at plant sites will continue to grow until an interim storage facility or a permanent repository can be opened—or until alternative treatment and disposal technology is developed. DOE's most recent estimates of the total amount of U.S. commercial spent fuel that may eventually require disposal range from 105,000 metric tons[77] to 130,000 metric tons.[78]

New storage capacity at operating nuclear plant sites or other locations will be required if DOE is unable to begin accepting waste into its disposal system for an indefinite period. Most utilities are expected to construct new dry storage capacity at reactor sites. Sixty-two licensed dry storage facilities were operating at nuclear plant sites in the United States at the end of 2013.[79]

The terrorist attacks of September 11, 2001, heightened concerns about the vulnerability of stored spent fuel. Concerns have been raised that an aircraft crash into a reactor's pool area or acts of sabotage could drain the pool and cause the spent fuel inside to overheat. A report released by NRC January 17, 2001, found that overheating could cause the zirconium alloy cladding of spent fuel to catch fire and release hazardous amounts of radioactivity, although it characterized the probability of such a fire as low.

In a report released April 6, 2005, the National Academy of Sciences (NAS) found that "successful terrorist attacks on spent fuel pools, though difficult, are possible." To reduce the likelihood of spent fuel cladding fires, the NAS study recommended that hotter and cooler spent fuel assemblies be interspersed throughout spent fuel pools, that spray systems be installed above the pools, and that more fuel be transferred from pools to dry cask storage.[80] The nuclear industry contends that the several hours required for uncovered spent fuel to heat up enough to catch fire would allow ample time for alternative measures to cool the fuel. NRC's report on this issue in 2013 found only minor safety benefits in expedited transfers of spent fuel from pools to dry casks.[81]

The safety of spent fuel pools is one of the areas examined by an NRC task force that identified near-term lessons that the Fukushima accident may hold for U.S. nuclear power plant regulation. The task force recommended that assured sources of electrical power as well as water spray systems be available for spent fuel pools.[82] NRC approved an order March 9, 2012, requiring U.S. reactors to install improved water-level monitoring equipment at their spent fuel pools.[83] For

[77] DOE Office of Civilian Radioactive Waste Management, *OCRWM Annual Report to Congress, Fiscal Year 2002*, DOE/RW-0560, October 2003, Appendix C.

[78] DOE Office of Civilian Radioactive Waste Management, *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*, Summary, DOE/EIS-0250F-S1D, October 2007, p. S-47.

[79] Gutherman, 2014. Excludes DOE facilities and the unconstructed Private Fuel Storage facility in Utah. In addition, GE operates an independent pool storage facility near Morris, IL.

[80] National Academy of Sciences, *Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report*, released April 6, 2005, p. 2.

[81] Nuclear Regulatory Commission, "Staff Evaluation and Recommendations for Japan Lessons-Learned Tier 3 Issue on Expedited Transfer of Spent Fuel," op. cit.

[82] U.S. Nuclear Regulatory Commission, Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, *Recommendations for Enhancing Reactor Safety in the 21st Century*, p. 46, http://pbadupws.nrc.gov/docs/ML1118/ML111861807.pdf.

[83] Nuclear Regulatory Commission, "NRC to Issue Orders, Information Request as Part of Implementing Fukushima-Related Recommendations," press release, March 9, 2012, http://www.nrc.gov/reading-rm/doc-collections/news/2012/12-023.pdf.

more background, see CRS Report R42513, *U.S. Spent Nuclear Fuel Storage*, by James D. Werner.

Commercial Low-Level Waste

About 1.1 million cubic feet of low-level waste with about 70,719 curies of radioactivity was shipped to commercial disposal sites in 2014, according to DOE.[84] Volumes and radioactivity can vary widely from year to year, based on the status of nuclear decommissioning projects and cleanup activities that can generate especially large quantities. The radioactivity of low-level waste is only a tiny fraction of the amount in annual discharges of spent fuel.

Low-level radioactive waste is divided into three major categories for handling and disposal: Class A, B, and C. Class A waste constitutes most of the annual volume of low-level waste, while classes B and C generally contain most of the radioactivity. As discussed below, most of the nation's Class B and C waste has been stored where it has been generated since June 2008 for lack of a permanent disposal site. For more background on radioactive waste characteristics, see CRS Report RL32163, *Radioactive Waste Streams: Waste Classification for Disposal*, by Anthony Andrews.

Current Policy and Regulation

Disposal of spent fuel and high-level waste is a federal responsibility, while states are authorized to develop disposal facilities for commercial low-level waste. The Obama Administration has halted the Yucca Mountain repository, although it remains the sole candidate site for civilian highly radioactive waste disposal under current law. DOE issued an alternative waste management strategy in January 2013 that calls for a pilot facility for spent fuel storage to open at a voluntary site by 2021 and a new repository by 2048. New legislation would be required to carry out the strategy.

Spent Nuclear Fuel

Current Program and Proposed Policy Changes

The Nuclear Waste Policy Act established a system for selecting a geologic repository for the permanent disposal of up to 70,000 metric tons (77,000 tons) of spent nuclear fuel and high-level waste. DOE's Office of Civilian Radioactive Waste Management (OCRWM) was created to carry out the program. The Nuclear Waste Fund, holding receipts from a fee on commercial nuclear power) and federal contributions for emplacement of high-level defense waste, was established to pay for the program. The fee, set at a tenth of a cent per kilowatt-hour, can be adjusted by the Secretary of Energy based on projected total program costs after a congressional review period. DOE was required to select three candidate sites for the first national high-level waste repository.

[84] U.S. Department of Energy, Management Information Manifest System, http://mims.doe.gov/GeneratorData.aspx. Most recent year reported.

After much controversy over DOE's implementation of NWPA, the act was substantially modified by the Nuclear Waste Policy Amendments Act of 1987 (Title IV, Subtitle A of P.L. 100-203, the Omnibus Budget Reconciliation Act of 1987). Under the amendments, the only candidate site DOE may consider for a permanent high-level waste repository is at Yucca Mountain, Nevada. If that site cannot be licensed, DOE must return to Congress for further instructions.

The 1987 amendments also authorized construction of a monitored retrievable storage (MRS) facility to store spent fuel and prepare it for delivery to the repository. But because of fears that the MRS would reduce the need to open the permanent repository and become a de facto repository itself, the law forbids DOE from selecting an MRS site until recommending to the President that a permanent repository be constructed, and construction of an MRS cannot begin until Yucca Mountain receives a construction permit. The repository recommendation was made in February 2002, but DOE has not announced any plans for siting an MRS.

Along with halting all funding for the Yucca Mountain project, the Obama Administration terminated OCRWM at the end of FY2010 and transferred its remaining functions to DOE's Office of Nuclear Energy. The Administration established the Blue Ribbon Commission on America's Nuclear Future (BRC) to develop a new waste management strategy, and the BRC issued its final report on January 26, 2012.[85]

As required by its charter, the BRC did not evaluate specific sites for new nuclear waste facilities, including Yucca Mountain. However, the commission concluded that the existing nuclear waste policy, with Yucca Mountain identified by law as the sole candidate site, "has now all but completely broken down" and "seems destined to bring further controversy, litigation, and protracted delay." The BRC recommended instead that Congress establish "a new, consent-based approach to siting." Under that approach, potential sites would be the subject of extensive negotiations with affected states, tribes, and local governments. Such negotiations would result in legally binding agreements on the roles of the affected parties, including local oversight, and other project parameters.

The BRC noted that previous U.S. efforts to find voluntary waste sites had failed, but it nevertheless expressed confidence that such a process could eventually succeed. In particular, the commission highlighted the U.S. experience with the Waste Isolation Pilot Plant (WIPP) in New Mexico, which, after many years of controversy, began receiving transuranic defense waste in 1999 with state and local government approval.

To carry out the new waste management program, the BRC recommended that a congressionally chartered federal corporation be established. Such a corporation would be independent from Administration control and have "assured access to funds" but be subject to congressional oversight and to regulation by NRC. Pending establishment of the corporation, the BRC recommended that administrative and legislative changes be implemented in the Nuclear Waste Fund to allow funds to be used for the waste management program without having to compete with other appropriations priorities.

The BRC called for "prompt efforts" to develop a permanent underground nuclear waste repository and to develop one or more interim central storage facilities. Interim storage facilities are especially needed so that waste can be removed from shutdown reactor sites, the commission

[85] BRC Final Report, op. cit.

said. Development of a permanent disposal site would have to be undertaken along with the interim storage effort to assure that interim sites would not become "de facto" permanent repositories, according to the commission.

In response to the BRC report, and to provide an outline for a new nuclear waste program, DOE issued its *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Waste* in January 2013.[86] Under the DOE strategy, a pilot interim spent fuel storage facility would be opened by 2021, focusing primarily on spent fuel from decommissioned nuclear plants. A larger-scale interim storage facility, which could be an expansion of the pilot facility, would open by 2025 with a capacity of 20,000 metric tons or more.

The DOE strategy called for the interim storage facility to be linked to development of a permanent repository so that the storage facility would not become a *de facto* repository. However, the strategy noted that the existing NWPA restrictions on the MRS are so rigid that the MRS cannot currently be built. Without describing specific provisions, the DOE strategy recommended that "this linkage should not be such that it overly restricts forward movement on a pilot or larger storage facility that could make progress against the waste management mission."

Under the DOE strategy, a geologic disposal facility would open by 2048—50 years after the initially planned opening date for the Yucca Mountain repository. A site for the repository is to be selected by 2016, and site suitability studies, design, and licensing are to be completed by 2042.

Sites for the proposed storage and disposal facilities would be selected through a "consent based" process, as recommended by the BRC. However, the DOE strategy included few details on how such a process would be implemented. Instead, the strategy said the Obama Administration would soon begin consultations with Congress and interest groups on "defining consent, deciding how that consent is codified, and determining whether or how it is ratified by Congress." The program would be implemented by a new nuclear waste management entity, as recommended by the BRC, but the nature of the new organization was not specified by the DOE strategy. A bill introduced by Senator Alexander (S. 854), discussed under "Congressional Action," would modify the waste program along the lines of the Administration's waste strategy. Other proposals have called for privatization of waste management services.[87]

DOE issued a report in October 2014 that recommended testing the consent-based approach by siting and developing a repository solely for defense and research waste. According to the report, a separate repository for such waste would not be subject to the Yucca Mountain siting requirement that applies to a civilian nuclear waste repository under NWPA. The idea would reverse long-standing federal policy, established by the Reagan Administration, that a single repository would hold both civilian and defense high-level waste and spent fuel. DOE's 2014 report concluded that a separate repository for the nation's relatively small volumes of defense and research waste (compared to civilian waste) could be developed more quickly, "within existing legislative authority," than a repository for all highly radioactive waste. The report also

[86] DOE, *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Waste*, op. cit.

[87] Spencer, Jack, "Nuclear Waste Management: Minimum Requirements for Reforms and Legislation," Heritage Foundation, March 28, 2013, http://www.heritage.org/research/reports/2013/03/nuclear-waste-management-minimum-requirements-for-reforms-and-legislation.

recommended that disposal in deep boreholes be considered for the most compact types of defense and research waste.[88]

President Obama authorized DOE on March 24, 2015, to begin planning a separate underground repository for high-level radioactive waste generated by nuclear defense activities. Energy Secretary Moniz said at the same time that DOE would begin implementing a process to locate voluntary sites for storage and disposal of civilian nuclear waste.[89]

Private Interim Storage

The waste management company Waste Control Specialists (WCS) announced February 7, 2015, that it would apply for an NRC license to develop an interim storage facility for spent nuclear fuel in Texas. The spent fuel storage facility would be built at a 14,000-acre WCS site near Andrews, TX, where the company currently operates two low-level radioactive waste storage facilities with local support. WCS said it would submit the final license application for the interim storage facility by April 2016 and complete construction by December 2020.[90] Under the WCS proposal, DOE would take title to spent fuel at nuclear plant sites, ship it to the Texas site, and pay WCS for storage for up to 40 years with possible extensions, according to media reports. DOE's costs would be covered through appropriations from the Nuclear Waste Fund, as were most costs for the Yucca Mountain project. WCS contends that a privately developed spent fuel storage facility would not be bound by NWPA restrictions that prohibit DOE from building a storage facility without making progress on Yucca Mountain.[91]

Local officials near the WIPP facility have long supported the development of additional waste facilities at that site, which was originally planned to hold high-level waste before the state objected. A presentation by a top New Mexico official on March 1, 2012, described conditions under which the state might be willing to accept high-level waste and spent fuel at the WIPP site, such as assistance with cleaning up the state's contaminated uranium production sites.[92] A local government consortium near the WIPP site, the Eddy-Lea Energy Alliance (ELEA), sent a letter to NRC on February 26, 2013, saying that it would submit a license application for the consolidated spent fuel storage facility envisioned by DOE's waste strategy report. "As details of the DOE strategy are implemented, we will keep the NRC staff advised of our progress," the letter said.[93] ELEA announced on April 29, 2015, that it had reached an agreement with Holtec

[88] DOE, *Assessment of Disposal Options for DOE-Managed High-Level Radioactive Waste and Spent Nuclear Fuel*, October 2014, http://www.energy.gov/ne/downloads/assessment-disposal-options-doe-managed-high-level-radioactive-waste-and-spent-nuclear.

[89] Energy Secretary Ernest Moniz, "A Look Back on the Blue Ribbon Commission on America's Nuclear Future," remarks to Bipartisan Policy Center, March 24, 2015, http://www.energy.gov/articles/secretary-monizs-remarks-look-back-blue-ribbon-commission-america-s-nuclear-future.

[90] Valhi, Inc., "Valhi's Waste Control Specialists Subsidiary to Apply for License to Store Used Nuclear Fuel," February 7, 2015, http://www.valhi.net/phoenix.zhtml?c=103380&p=irol-newsArticle&ID=2014598.

[91] Beattie, Jeff, "Waste Control Specialists Sets 2020 Date to Open Spent Fuel Storage Facility," *IHS The Energy Daily*, February 10, 2015, p. 1; Hiruo, Elaine, "Texas Company Seeks License for Spent Fuel Storage," *Nucleonics Week*, February 12, 2015, p. 1.

[92] Elaine Hiruo and Herman Wang, "New Mexico Interested in Facilities for Waste Storage, Disposal: Officials," *NuclearFuel*, March 5, 2012, p. 3.

[93] Maddox, James M., Chairman, Eddy-Lea Energy Alliance, LLC, "Notice of Intent to Submit a License Application for Consolidated Used Nuclear Fuel Storage Facility," February 26, 2013, http://pbadupws.nrc.gov/docs/ML1306/ML13067A278.pdf.

International to develop the storage facility. New Mexico Governor Susana Martinez expressed support for ELEA's efforts in an April 10, 2015, letter to Energy Secretary Ernest Moniz, but the state's U.S. senators, Tom Udall and Martin Heinrich, said in a joint statement that they would oppose an interim storage facility without a plan for permanent disposal.[94] Moreover, a February 2014 radioactive release from WIPP, which led to the suspension of disposal operations, could also affect public support in the state for expanded waste activities.

Interest in hosting nuclear waste sites has also been expressed by groups in Mississippi and Loving County, Texas, although whether they would be developed by the private sector or the government has not been specified.[95]

An earlier effort to develop a private spent fuel storage facility was undertaken after it became apparent that DOE would miss the 1998 deadline for taking nuclear waste from reactor sites. A utility consortium signed an agreement with the Skull Valley Band of the Goshute Indians in Utah on December 27, 1996, to develop a storage facility on tribal land. The Private Fuel Storage (PFS) consortium submitted a license application to NRC on June 25, 1997, and a 20-year license for storing up to 44,000 tons of spent fuel in dry casks was issued on February 21, 2006. However, NRC noted that Interior Department approval would also be required.

On September 7, 2006, the Department of the Interior issued two decisions against the PFS project. The Bureau of Indian Affairs disapproved a proposed lease of tribal trust lands to PFS, concluding there was too much risk that the waste could remain at the site indefinitely.[96] The Bureau of Land Management rejected the necessary rights-of-way to transport waste to the facility, concluding that a proposed rail line would be incompatible with the Cedar Mountain Wilderness Area and that existing roads would be inadequate.[97]

The Skull Valley Band of Goshutes and PFS filed a federal lawsuit July 17, 2007, to overturn the Interior decisions on the grounds that they were politically motivated.[98] A federal district court judge on July 26, 2010, ordered the Department of the Interior to reconsider its decisions on the PFS permits.[99] However, PFS asked NRC to terminate its license on December 20, 2012.[100]

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[94] "New Mexico Pursues Interim Storage," *Nuclear News*, June 2015, p. 60. "Udall, Heinrich Statements on Proposed Interim Nuclear Waste Facility in New Mexico," news release, April 30, 2015, http://www.tomudall.senate.gov/?p=press_release&id=1947.

[95] Housley Carr and Elaine Hiruo, "Group Urges Mississippi to Become Home to Spent Fuel Facilities," *NuclearFuel*, September 2, 2013.

[96] Bureau of Indian Affairs, *Record of Decision for the Construction and Operation of an Independent Spent Fuel Storage Installation (ISFSI) on the Reservation of the Skull Valley Band of Goshute Indians (Band) in Tooele County, Utah*, September 7, 2006.

[97] Bureau of Land Management, *Record of Decision Addressing Right-of-Way Applications U 76985 and U 76986 to Transport Spent Nuclear Fuel to the Reservation of the Skull Valley Band of Goshute Indians*, September 7, 2006.

[98] Winslow, Ben, "Goshutes, PFS Sue Interior," *Deseret Morning News*, July 18, 2007.

[99] U.S. District Court for the District of Utah, *Skull Valley Band of Goshute Indians and Private Fuel Storage v. United States Department of the Interior*, Civil Action No. 07-cv-0526-DME-DON, July 26, 2010, http://64.38.12.138/docs/court/goshute/order072610.pdf.

[100] Palmberg, Robert M., Chairman of the Board, Private Fuel Storage LLC, letter to Nuclear Regulatory Commission, December 20, 2012, http://pbadupws.nrc.gov/docs/ML1235/ML12356A063.pdf.

Regulatory Requirements for Yucca Mountain

Although the Obama Administration wants to redirect the high-level nuclear waste program, current law still focuses on Yucca Mountain for civilian waste. NWPA requires that high-level waste repositories be licensed by NRC in accordance with general standards issued by EPA. Under the Energy Policy Act of 1992 (P.L. 102-486), EPA was required to write new repository standards specifically for Yucca Mountain. NWPA also requires the repository to meet general siting guidelines prepared by DOE and approved by NRC. Transportation of waste to storage and disposal sites is regulated by NRC and the Department of Transportation (DOT). Under NWPA, DOE shipments to Yucca Mountain and an MRS facility would have to use NRC-certified casks and comply with NRC requirements for notifying state and local governments. Shipments would also have to follow DOT regulations on routing, placarding, and safety.

NRC's licensing requirements for Yucca Mountain, at 10 C.F.R. 63, require compliance with EPA's standards (described below) and establish procedures that DOE must follow in seeking a repository license. For example, DOE is required to conduct a repository performance confirmation program that would indicate whether natural and man-made systems were functioning as intended and assure that other assumptions about repository conditions were accurate.

Specific standards for Yucca Mountain were required because of concerns that some of EPA's general standards might be impossible or impractical to meet at Yucca Mountain.[101] The Yucca Mountain standards, which limit the radiation dose that the repository could impose on individual members of the public, were required to be consistent with the findings of a study by the National Academy of Sciences (NAS), which was issued August 1, 1995.[102] The NAS study recommended that the Yucca Mountain environmental standards establish a limit on risk to individuals near the repository, rather than setting specific limits for the releases of radioactive material or on radioactive doses, as under previous EPA standards. The NAS study also examined the potential for human intrusion into the repository and found no scientific basis for predicting human behavior thousands of years into the future.

Pursuant to the Energy Policy Act of 1992, EPA published its proposed Yucca Mountain radiation protection standards on August 27, 1999. The proposal would have limited annual radiation doses to 15 millirems for the "reasonably maximally exposed individual," and to 4 millirems from groundwater exposure, for the first 10,000 years of repository operation. EPA calculated that its standard would result in an annual risk of fatal cancer for the maximally exposed individual of seven chances in a million. The nuclear industry criticized the EPA proposal as being unnecessarily stringent, particularly the groundwater standard. On the other hand, environmental groups contended that the 10,000-year standard proposed by EPA was too short, because DOE had projected that radioactive releases from the repository would peak after about 400,000 years.

EPA issued its final Yucca Mountain standards on June 6, 2001. The final standards included most of the major provisions of the proposed version, including the 15 millirem overall exposure limit and the 4 millirem groundwater limit. Despite the department's opposition to the EPA standards, DOE's site suitability evaluation determined that the Yucca Mountain site would be able to meet

[101] See, for example: NRC, "Analysis of Energy Policy Act of 1992 Issues Related to High-Level Waste Disposal Standards, SECY-93-013, January 25, 1993, attachment p. 4.

[102] National Research Council. *Technical Bases for Yucca Mountain Standards*. National Academy Press. 1995.

them. NRC revised its repository regulations September 7, 2001, to conform to the EPA standards.

A three-judge U.S. Court of Appeals panel on July 9, 2004, struck down the 10,000-year regulatory compliance period in the EPA and NRC Yucca Mountain standards.[103] The court ruled that the 10,000-year period was inconsistent with the NAS study on which the Energy Policy Act required the Yucca Mountain regulations to be based. In fact, the court found, the NAS study had specifically rejected a 10,000-year compliance period because of analysis that showed peak radioactive exposures from the repository would take place several hundred thousand years in the future.

In response to the court decision, EPA proposed a new version of the Yucca Mountain standards on August 9, 2005. The proposal would have retained the dose limits of the previous standard for the first 10,000 years but allowed a higher annual dose of 350 millirems for the period of 10,000 years through 1 million years. EPA also proposed to base the post-10,000-year Yucca Mountain standard on the median dose, rather than the mean, potentially making it easier to meet.[104] Nevada state officials called EPA's proposed standard far too lenient and charged that it was "unlawful and arbitrary."[105]

EPA issued its final rule to amend the Yucca Mountain standards on September 30, 2008. The final rule reduced the annual dose limit during the period of 10,000 through 1 million years from the proposed 350 millirems to 100 millirems, which the agency contended was consistent with international standards. Under the final rule, compliance with the post-10,000-year standard will be based on the arithmetic mean of projected doses, rather than the median as proposed. The 4 millirem groundwater standard will continue to apply only to the first 10,000 years.[106] NRC revised its repository licensing regulations to conform to the new EPA standards on April 13, 2009.[107] (For more information, see CRS Report RL34698, *EPA's Final Health and Safety Standard for Yucca Mountain*, by Bonnie C. Gitlin.)

DOE estimated in its June 2008 Final Supplemental Environmental Impact Statement (FSEIS) for the Yucca Mountain repository that the maximum mean annual individual dose after 10,000 years would be 2 millirems. That is substantially below the level estimated by the 2002 Final Environmental Impact Statement, which calculated that the peak doses—occurring after 400,000 years—would be about 150 millirems (Volume 1, Chapter 5). The FSEIS attributed the reduction to changes in DOE's computer model and in the assumptions used, noting that "various elements of DOE's modeling approach may be challenged as part of the NRC licensing process."[108]

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[103] *Nuclear Energy Institute v. Environmental Protection Agency*, U.S. Court of Appeals for the District of Columbia Circuit, No. 01-1258, July 9, 2004.

[104] Especially high doses at the upper end of the exposure range would raise the mean, or average, more than the median, or the halfway point in the data set.

[105] Office of the Governor, Agency for Nuclear Projects. *Comments by the State of Nevada on EPA's Proposed New Radiation Protection Rule for the Yucca Mountain Nuclear Waste Repository*. November 2005.

[106] Posted on the EPA website at http://www.epa.gov/radiation/yucca.

[107] Nuclear Regulatory Commission, "Implementation of a Dose Standard After 10,000 Years," 74 *Federal Register* 10811, March 13, 2009.

[108] FSEIS, p. S-42. Posted on the DOE website at http://www.rw.doe.gov/ym_repository/seis/docs/002_Summary.pdf.

Alternative Technologies

DOE's Fuel Cycle Research and Development Program conducts "long-term, science-based" research on a wide variety of technologies for improving the management of spent nuclear fuel, as well as implementation of the Administration's integrated waste strategy, according to the FY2016 DOE budget justification. The total FY2016 funding request for this program was $217.8 million, $20.8 million above the FY2015 appropriation. The House provided $175.8 million, eliminating funds for the integrated waste strategy and new facilities for defense and other DOE-managed waste. The Senate Appropriations Committee recommended $217.0 million, including $97.0 million for the Used Nuclear Fuel Disposition program.

A major focus of the Fuel Cycle R&D program is technology related to the reprocessing or "recycling" of spent fuel so that plutonium, uranium, and other long-lived radionuclides could be converted to faster-decaying fission products in special nuclear reactors or particle accelerators. Emplacing waste in deep boreholes, at much greater depths than most proposed repositories, is also being investigated. According to the FY2016 budget justification, "The Department will initiate a field test that will include the drilling of a characterization borehole at a volunteer site that will be selected in the future."

Other long-term disposal alternatives to geologic repositories are disposal below the seabed and transport into space, neither of which is currently being studied by DOE.

Funding and Costs

The Obama Administration's FY2011 budget request called for a complete halt in funding for the Yucca Mountain project and elimination of OCRWM. In line with the request, the FY2011 Continuing Appropriations Act (P.L. 112-10) provided no DOE funding for the program. DOE shut down the Yucca Mountain project at the end of FY2010 and transferred OCRWM's remaining functions to the Office of Nuclear Energy.

President Obama's FY2016 federal budget, submitted to Congress in February 2015, included no funding for Yucca Mountain but requested $30.0 million to conduct research and analysis in support of DOE's January 2013 nuclear waste strategy. The Administration's request included $24.0 million to be appropriated from the Nuclear Waste Fund and a proposal that discretionary appropriations beginning in FY2019 be supplemented by mandatory appropriations. The House-passed version of the FY2016 Energy and Water Development appropriations bill (H.R. 2028), rejected funding for the Administration's nuclear waste management program and provided $175 million to continue the Yucca Mountain licensing process.

Following the pattern of recent years, the Senate Appropriations Committee's version of the FY2016 Energy and Water bill did not include funding for Yucca Mountain but authorized a pilot consolidated nuclear waste surface storage facility (Sec. 306). Siting of the pilot storage facility would require the consent of the host state and local governments and affected Indian tribes. Priority for use of the facility would be given to spent fuel at closed reactor sites. Similar provisions have been included in previous Senate committee and subcommittee bills but not enacted. Another provision in the FY2016 Senate committee bill (Sec. 311) would explicitly authorize the Secretary of Energy to contract with a private facility—such as the proposed Texas facility discussed above—to store commercial spent fuel to which DOE has taken title. The Senate Committee bill also would provide $30 million to implement Sections 306 and 311. An additional $3 million would be appropriated to prepare for spent fuel transportation to the interim

storage facility, as well as $3 million to "develop disposal pathways for defense high-level radioactive waste."

Although nuclear utilities had paid fees to the Nuclear Waste Fund to cover the disposal costs of civilian nuclear spent fuel (until halted by a court order in May 2014), DOE cannot spend the money in the fund until it is appropriated by Congress. At the end of FY2014, the Waste Fund balance stood at $32.9 billion, according to the Department of the Treasury.[109] Before the Obama Administration halted the Yucca Mountain project, $7.41 billion had been disbursed from the Waste Fund, according to DOE's program summary report.[110] DOE's most recent update of its *Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Management Program* was released on August 5, 2008.[111] According to that estimate, the Yucca Mountain program as then planned would cost $96.2 billion in 2007 dollars from the beginning of the program in 1983 to repository closure in 2133.

Low-Level Radioactive Waste

Current Policy

Selecting disposal sites for low-level radioactive waste, which generally consists of low concentrations of relatively short-lived radionuclides, is authorized to be conducted by states under the 1980 Low-Level Radioactive Waste Policy Act and 1985 amendments. Most states have joined congressionally approved interstate compacts to handle low-level waste disposal. Under the 1985 amendments, the nation's three (at that time) operating commercial low-level waste disposal facilities could start refusing to accept waste from outside their regional interstate compacts after the end of 1992. One of the three sites, near Beatty, NV, closed. The remaining two—at Barnwell, SC, and Hanford, WA—are using their congressionally granted authority to prohibit waste from outside their regional compacts. Another site, in Utah, has since become available nationwide for most Class A low-level waste, but class B and C waste generally must be stored at the sites where it is generated.

The startup of a new disposal facility for Class A, B, and C low-level waste near Andrews, TX, in 2012 may alleviate the class B and C storage problem. Although the facility is intended to serve primarily Texas and Vermont, up to 30% of its 2.3 million cubic feet of disposal capacity may be allocated to waste from other states.[112] The Texas site received its first shipment of waste, from a company in Vermont, on April 27, 2012.[113]

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[109] DOE, Office of Inspector General, *Department of Energy's Nuclear Waste Fund's Fiscal Year 2014 Financial Statement Audit*, OAS-FS-15-03, November 24, 2014, p. 8, http://energy.gov/ig/downloads/audit-report-oas-fs-15-03. Excludes $3.1 billion in unpaid one-time fees for waste generated before enactment of NWPA.

[110] DOE, Office of Civilian Radioactive Waste Management, Office of Program Management, *Monthly Summary of Program Financial and Budget Information*, as of January 31, 2010, available at http://www.thenwsc.org/ym/DOE%20Financial%20&%20Budget%20Summary%20013110.pdf. The report notes that some figures may not add due to independent rounding.

[111] Available on the DOE website at http://energy.gov/sites/prod/files/gcprod/documents/FY_2007_TotalSystemLifeCycleCost_Pub2008.pdf.

[112] Waste Control Specialists, "Our Facilities: Compact Waste Facility," http://www.wcstexas.com/facilities/compact-waste-facility/.

[113] Bionomics, Inc., "Bionomics Makes First Shipment to Texas Low Level Waste Site," press release, April 27, 2012, http://www.bionomics-inc.com/documents/Newsletter/First%20Shipment%20to%20Texas.pdf.

Legislation providing congressional consent to the Texas compact, which originally also included Maine as well as Vermont, was signed by President Clinton September 20, 1998 (P.L. 105-236). However, on October 22, 1998, a proposed disposal site near Sierra Blanca, TX, was rejected by the Texas Natural Resource Conservation Commission, and Maine subsequently withdrew. Texas Governor Rick Perry signed legislation June 20, 2003, authorizing the Texas Commission on Environmental Quality (TCEQ) to license adjoining disposal facilities for commercial and federally generated low-level waste. Pursuant to that statute, an application to build the Andrews County disposal facility was filed August 2, 2004, by Waste Control Specialists LLC. TCEQ voted January 14, 2009, to issue the license after the necessary land and mineral rights had been acquired and approved construction of the facility January 7, 2011.[114]

The disposal facility at Barnwell, SC, is currently accepting all Class A, B, and C low-level waste from the Atlantic Compact (formerly the Northeast Compact), in which South Carolina joined original members Connecticut and New Jersey on July 1, 2000. Under the compact, South Carolina can limit the use of the Barnwell facility to the three compact members, and a state law enacted in June 2000 phased out acceptance of non-compact waste through June 30, 2008. The Barnwell facility previously had stopped accepting waste from outside the Southeast Compact at the end of June 1994. The Southeast Compact Commission in May 1995 twice rejected a South Carolina proposal to open the Barnwell site to waste generators outside the Southeast and to bar access to North Carolina until that state opened a new regional disposal facility, as required by the compact. The rejection of those proposals led the South Carolina General Assembly to vote in 1995 to withdraw from the Southeast Compact and begin accepting waste at Barnwell from all states but North Carolina. North Carolina withdrew from the Southeast Compact July 26, 1999. The U.S. Supreme Court ruled on June 1, 2010, that the withdrawal did not subject North Carolina to sanctions under the compact.[115]

The only other existing disposal facility for all three major classes of low-level waste is at Hanford, WA. Controlled by the Northwest Compact, the Hanford site will continue taking waste from the neighboring Rocky Mountain Compact under a contract. Since the South Carolina facility closed to out-of-region waste, and pending planned imports by the Texas compact, the 34 states and the District of Columbia that are outside the Northwest, Rocky Mountain, Atlantic, and Texas compacts have had no disposal site for Class B and C low-level waste.

Regulatory Requirements

Licensing of commercial low-level waste facilities is carried out under the Atomic Energy Act by NRC or by "agreement states" with regulatory programs approved by NRC. NRC regulations governing low-level waste licenses[116] must conform to general environmental protection standards and radiation protection guidelines issued by EPA. Transportation of low-level waste is jointly regulated by NRC and the Department of Transportation.

NRC proposed a significant modification of its low-level waste disposal regulations on March 26, 2015.[117] Among the proposed changes are a requirement that technical analyses for disposal sites

[114] See the TCEQ website, http://www.tceq.state.tx.us/permitting/radmat/licensing/wcs_license_app.html#wcs_status.

[115] *Alabama et al. v. North Carolina*, S. Ct. (2010), http://www.supremecourt.gov/opinions/09pdf/132Orig.pdf.

[116] 10 Code of Federal Regulations Part 61, Licensing Requirements for Land Disposal of Radioactive Waste.

[117] NRC, "Low-Level Radioactive Waste Disposal; Proposed Rule," 80 *Federal Register* 16082, March 26, 2015.

include a 1,000-year compliance period for the general public and a dose limit for inadvertent intruders. New analyses would be required for 10,000-year and post-10,000-year periods, along with annual dose minimization targets for the first 10,000 years. NRC's current low-level waste regulations were adopted in 1982.

Concluding Discussion

Disposal of radioactive waste will be a key issue in the continuing nuclear power debate. Without a national waste management system, spent fuel from nuclear power plants must be stored on-site indefinitely. This situation may raise public concern near proposed reactor sites, particularly at sites without existing reactors where spent nuclear fuel is already stored. Concern about spent fuel storage safety has been heightened by the March 2011 disaster at Japan's Fukushima Daiichi nuclear plant.

Under current law, the federal government's nuclear waste disposal policy is focused on the Yucca Mountain site. However, President Obama's actions to terminate the Yucca Mountain project and develop a new waste strategy through the Blue Ribbon Commission on America's Nuclear Future have brought most activities in the DOE waste program to a halt. Congress is continuing to debate the project's termination, particularly through the appropriations process. The NRC staff's finding in October 2014 that the Yucca Mountain site would meet NRC standards after the repository was filled and sealed has intensified criticism of the Administration's nuclear waste policy.

Because of their waste-disposal contracts with DOE, owners of existing reactors are likely to continue seeking damages from the federal government if disposal delays continue. For example, DOE's 2004 settlement with the nation's largest nuclear operator, Exelon, could require payments of up to $600 million from the federal judgment fund. DOE estimates that its potential liabilities for waste program delays could total as much as $27.1 billion, including $4.5 billion already paid to Exelon and other utilities in settlements and final judgments. The nuclear industry has predicted that future damages could rise by tens of billions of dollars more if the federal disposal program fails altogether.

Lack of a nuclear waste disposal system could also affect the licensing of proposed new nuclear plants, both because of NRC licensing guidelines and various state laws.[118] In addition, further repository delays could force DOE to miss compliance deadlines for defense waste disposal.

Problems being created by nuclear waste disposal delays were addressed by the Blue Ribbon Commission in its final report, issued in January 2012. Major options include centralized interim storage, continued storage at existing nuclear sites, reprocessing and waste treatment technology, development of alternative repository sites, or a combination. The commission recommended that a congressionally chartered corporation be established to undertake a negotiated process for siting new waste storage and disposal facilities. However, given the delays resulting from the ongoing shutdown of the nuclear waste program, longer on-site storage is almost a certainty under any option.

[118] Lovell, David L., Wisconsin Legislative Council Staff, *State Statutes Limiting the Construction of Nuclear Power Plants*, October 5, 2006.

The "consent based" nuclear waste siting process recommended by the Blue Ribbon Commission and authorized by the Senate Appropriations Committee has attracted serious interest from localities in New Mexico and Texas. However, previous voluntary siting efforts, such as those by the U.S. Nuclear Waste Negotiator established by the 1987 NWPA amendments, also attracted serious local interest but were ultimately blocked by the governments of the potential host states. Therefore, the cooperation of states is likely to be crucial to the success of any renewed "consent based" siting effort.

Selected Legislation

H.R. 1364 (Titus)/S. 691 (Reid)

Nuclear Waste Informed Consent Act. Prohibits NRC from authorizing construction of a nuclear waste repository unless the Secretary of Energy has reached an agreement with the host state and affected units of local government and Indian tribes. House bill introduced March 13, 2015; referred to Committee on Energy and Commerce. Senate bill introduced March 10, 2015; referred to Committee on Environment and Public Works.

H.R. 2028 (Simpson)

Energy and Water Development Appropriations Bill, 2016. Includes funding for licensing the Yucca Mountain nuclear waste repository and nuclear waste R&D. Draft bill approved by the Subcommittee on Energy and Water Development of the Committee on Appropriations on April 15, 2015, and approved by the full committee April 22, 2015. Reported as an original measure by the House Committee on Appropriations April 24, 2015 (H.Rept. 114-91). Passed House May 1, 2015, by a vote of 240-177. Reported by the Senate Committee on Appropriations May 21, 2015 (S.Rept. 114-54).

S. 854 (Alexander)

Nuclear Waste Administration Act of 2015. Establishes an independent Nuclear Waste Administration (NWA) to develop nuclear waste storage and disposal facilities. Siting of such facilities would require the consent of the affected state, local, and tribal governments. NWA would be required to prepare a mission plan to open a pilot storage facility by the end of 2021 for nuclear waste from shutdown reactors and other emergency deliveries (called "priority waste"). A storage facility for waste from operating reactors or other "nonpriority waste" would open by the end of 2025, and a permanent repository by the end of 2048. The current disposal limit of 70,000 metric tons for the nation's first permanent repository would be repealed. Nuclear waste fees collected after enactment of the bill would be held in a newly established Working Capital Fund. The Nuclear Waste Administration could immediately draw from that fund any amounts needed to carry out S. 854, unless limited by annual appropriations or authorizations. Introduced March 24, 2015; referred to Committee on Energy and Natural Resources.

S. 944 (Boxer)

Safe and Secure Decommissioning Act of 2015. Requires NRC to maintain full safety and security requirements at permanently closed reactors until all their spent fuel was moved to dry storage. Introduced April 15, 2015; referred to Committee on Environment and Public Works.

S. 945 (Markey)

Dry Cask Storage Act of 2015. Requires nuclear power plants to develop NRC-approved plans for removing spent fuel from storage pools. Within seven years after such plans had been submitted, spent fuel would have to be transferred to dry storage facilities. After the seven-year period, additional spent fuel would have to be transferred to dry casks within a year after it had been determined to be sufficiently cool. Emergency planning zones would have to be expanded from 10 to 50 miles in radius around any reactor determined by NRC to be out of compliance with its spent fuel transfer plan. The emergency zone for a decommissioned reactor could not be reduced below a 10-mile radius until all its spent fuel had been placed in dry storage. NRC would be authorized to use interest earned by the Nuclear Waste Fund to provide grants to nuclear power plants to transfer spent fuel to dry storage. Introduced April 15, 2015; referred to Committee on Environment and Public Works.

S. 1825 (Reid)

Nuclear Waste Informed Consent Act. Prohibits the Secretary of Energy from making any expenditure from the Nuclear Waste Fund for developing nuclear waste storage and disposal facilities and conducting waste transportation activities unless agreements have been reached with affected states, local governments, and Indian tribes. Introduced July 22, 2015; referred to Committee on Energy and Natural Resources.

For Additional Reading

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Author Contact Information

Mark Holt
Specialist in Energy Policy
mholt@crs.loc.gov, 7-1704